AMERICAN MACHINIST

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Wrapping Machinery.

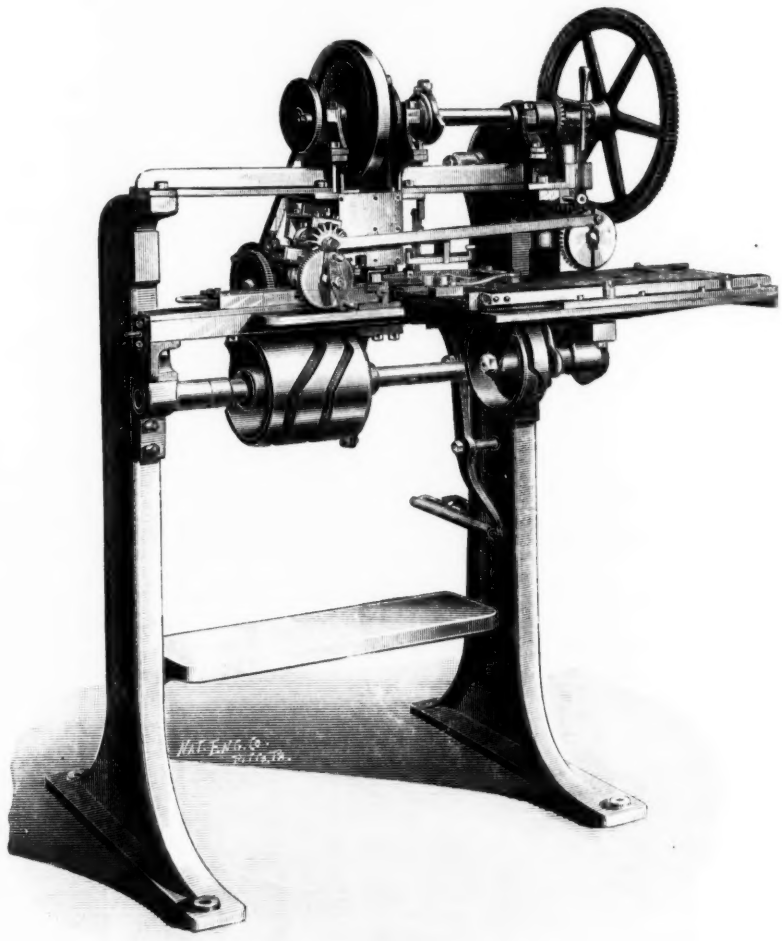
It has long been the desire of manufacturers of goods that are wrapped in paper, such as soap, and various kinds of candy, especially caramels, that a machine should be built which would do this work, and a number of attempts have been made to design machines for the purpose. On this page we give illustrations of two machines, the first of which is for wrapping caramels, and the other for cakes of soap. These are, we believe, the first really practical machines for this purpose, and they were designed by Mr. R. D. Nuttall, and are built by R. D. Nuttall & Co., of Allegheny, Pa.

Both machines are adjustable to all the commercial sizes of the articles they are intended to wrap, and are entirely automatic in their movements, doing from six to ten times the work that can be done by hand, and in a superior manner. In the caramel machine the caramels or other similar articles to be wrapped are cut in long strips, and fed in from the end of the machine, and the paper is fed from the back, being accurately measured on calender rolls, and cut off automatically by shears placed in the desired position. The caramel is also cut off by a knife to the desired length, and fed immediately onto the top of the paper, allowing the wrapping device to operate at once.

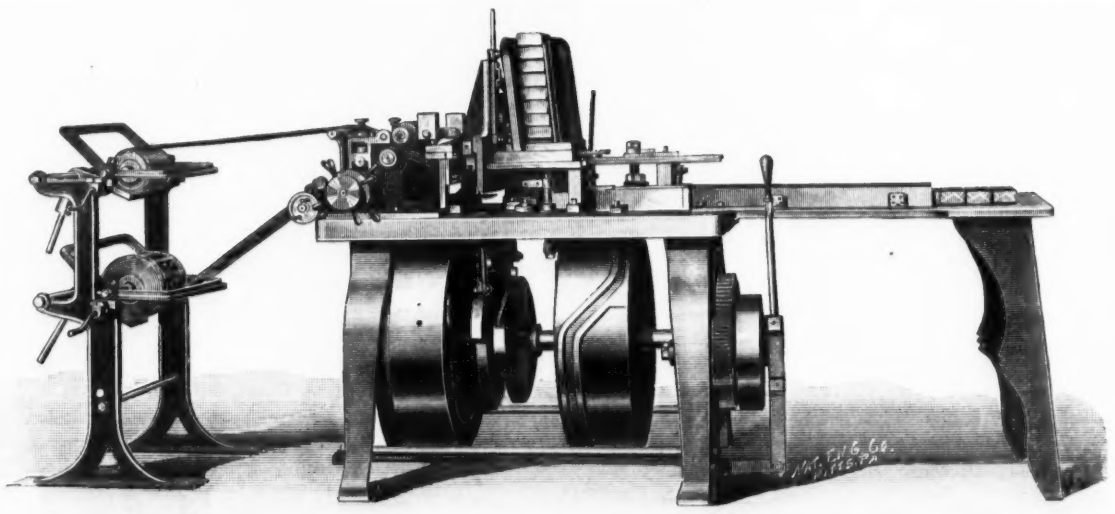
As each caramel is wrapped it is pushed out onto a tray automatically by a device especially designed for this purpose. When this tray is full it is removed from the machine by hand, and another one takes its place, and the work goes on steadily.

The soap wrapping machine, which, like the other, has been thoroughly tested in practical work in the factories, puts either a single or a double wrapper on the article, as desired, the soap or article to be wrapped being fed in from the top of the machine by a hopper as shown, and the paper fed from the rear, measured on calender rolls, and cut off automatically by shears placed in the desired position. The soap is then fed onto the top of the paper, after which it is carried down vertically to the wrapping devices of the machine, when it is pushed out ready for the boxing attachment to operate.

As each cake comes out it is taken and placed in a box automatically by a device especially designed for that purpose. After the box is filled it is taken from the machine by hand, and another takes its place, and the work goes on steadily. Both machines are very simple in their operations, and their management is easily learned by an intelligent boy in a few hours. The machines can of course be adapted to wrap other articles.



CARAMEL WRAPPING MACHINE.



SOAP WRAPPING MACHINE.

It is proposed to light the Bergen (Jersey City Heights) tunnel of the D., L. & W. Railroad by electricity, which, considering recent occurrences, is a rather bright thing to do, if electricity is best for the purpose.

If a man who has had, say, thirty years experience in the machine business looks back and sees the work he had to do in making the little tools he buys now as he wants them, he will have a rather invigorating idea of the progress that has been going on in that line. When it comes to heavy work, progress has been strongly marked; coming to little conveniences, everything has been absolutely changed.

Ancient and modern practice in pumping machinery is very well exemplified at the Jersey City pumping station. There are in one house two immense, by contrast, pumping engines of the old English type—weighted plungers, and a wilderness of rods and levers and clap-traps about the engines—while in another and more modest building are two compound direct-acting pumping engines, occupying but a small part of the space, but, as one of the engineers remarked, "beating the big engines out of sight." The day of these old ponderous pumping machines has gone by, but they were excellent in their day, the better types of the present day only denoting the progress that is to be expected.

Modern Development of the Steam Engine.

BY HARRIS TABOR.

SECOND PAPER.

The limit of rotative speed is soon reached with the Corliss engine, even when the largest dash-pots are used. It is probably due to this fact that we have two distinctive types of steam engines, viz., high and low speeds, and two classes of steam engineers, advocates respectively of each type. The Corliss adherents insist that the limit of speed imposed by the valve gear is one of the best features in its system, while their opponents maintain that the best possible results come only with more rapid rotation. The believers in the releasing valve gear look to Geo. H. Corliss as the source of all good in modern steam engineering, and the followers of the high speed doctrine bow to Mr. Chas. T. Porter as their patron saint.

It is safe to say that these two men stand out distinctly as originators and representatives of types of steam engines and engineering throughout the world. These types have grown alike, and it is difficult to decide which is the more popular. Neither has a location exclusively its own, for we find both in the cotton-mills of New England, in the saw-mills of the northwest, and in the rolling-mills and coal fields of Pennsylvania. A few years ago the Corliss had a field of its own where large sizes were required, but now the high speed builders are as ready to enter the race, where contracts call for engines to develop 1,000 horse-powers, as their slower moving competitors.

The advent of Mr. Corliss was the earlier, but Mr. Porter had the harder fight. Corliss could guarantee economy without encountering prejudice; he was in the field when there were no economical engines, and the guaranteed saving could be made large. Mr. Porter met the objection of generations to high speeds, which had to be overcome. Engines were crudely built in those days, and the designs were even worse than the workmanship; crank-pins and main bearings were small to the extent of flexure, and hot boxes were not uncommon in slow-running engines. The engine builder who went to the owner of such an engine, and proposed a speed three or four times as great, coupled with economy, had a difficult task on hand. It was rank heresy, not to be thought of. Every stop due to hot bearings during the life of the old engine came back like a nightmare to the owner and engineer, to assist in the fight against the innovation. The old engine was known to be small for the work, yet here was an engine builder who proposed to give a still smaller cylinder with a guarantee of relief. At this distance we cannot estimate the difficulty that beset the pioneer in the early days of the quick-running engine. It needed pluck, persist-

ence and ingenuity to combat the objections raised, and a man less enthusiastic might have given up the struggle, and left the question of high rotative speed an unsettled one.

It is not many years since this type of engine was backed by a single man; to-day its builders are numbered by the score, and if gauged by numbers, probably three-fourths of the automatic cut-off engines turned out in the United States are of this class.

The high rotative principle has not been confined to the expansive engine. The influence of Mr. Porter's work is seen in every throttling engine on the market. Manufacturers who used to give a rated speed of 60 to 100 revolutions, and a nominal power corresponding, now boldly advise 200 turns, and a mean effective pressure of 40 pounds for the same sized engine. The granger who was content to take a 7″x10″ cylinder ten years ago, and do the work then done with 8 horses in threshing, now insists upon doing twice that amount with the same cylinder dimensions, and the maker who cannot supply such a machine must lose his place on the market.

The growth in the modern steam engine has called for improved methods and better tools in its manufacture, as well as better design, and has tended to give the purchaser a much greater power at less first cost. One cannot realize the extent to which systematic manufacture in the production of engines is carried until he has visited a shop especially fitted for this purpose. In the old days, when this machine was a luxury in which but few indulged, it took its chances in the shop with the jobbing and repair work of the time; its progress depended upon the condition of general trade, and often a broken piece from a neighboring mill would cause the prime mover to be laid aside. Such methods cannot exist now. The modern builder must give his talent and capital exclusively to his engine trade, if he would maintain his position in the race, and this is what the best modern shops engaged in this branch of manufacture are doing.

Special machines are designed to take the place of lathe and planer, and specialists are required to run them. Our old friend, the all-around "jour.," is getting rarer each day, and in his place we get men skilled only in one branch of the trade, or on one class of tools. The ingenuity of the tool maker has revolutionized our craft, and, though we may feel regret over the departure of old traditions and customs, we gladly welcome the better system that has driven them out.

The distinctive feature of the Corliss or releasing valve engine is its valve gear. The conditions in the high-speed system call for positive moving valves, and the utmost simplicity in construction. A rotative speed of 300 revolutions does not take kindly to a multiplicity of parts and joints, or heavy weight. Mr. Porter realized this when he adopted the Allen valve gear for his high-speed system. These valves have all the requirements of quick motion; they are multi-ported to insure large steam admission, balanced against pressure and current, with easy adjustment for wear while running, and light enough to be always under control of the governor. The admission and cut-off valves are connected to a block under the influence of the governor, working in a link, the position of this block determining the point of cut-off. The exhaust valves are attached to a fixed point in the link. This system is suited to any speed that may be given the engine. A modification of this is used by other makers of engines.

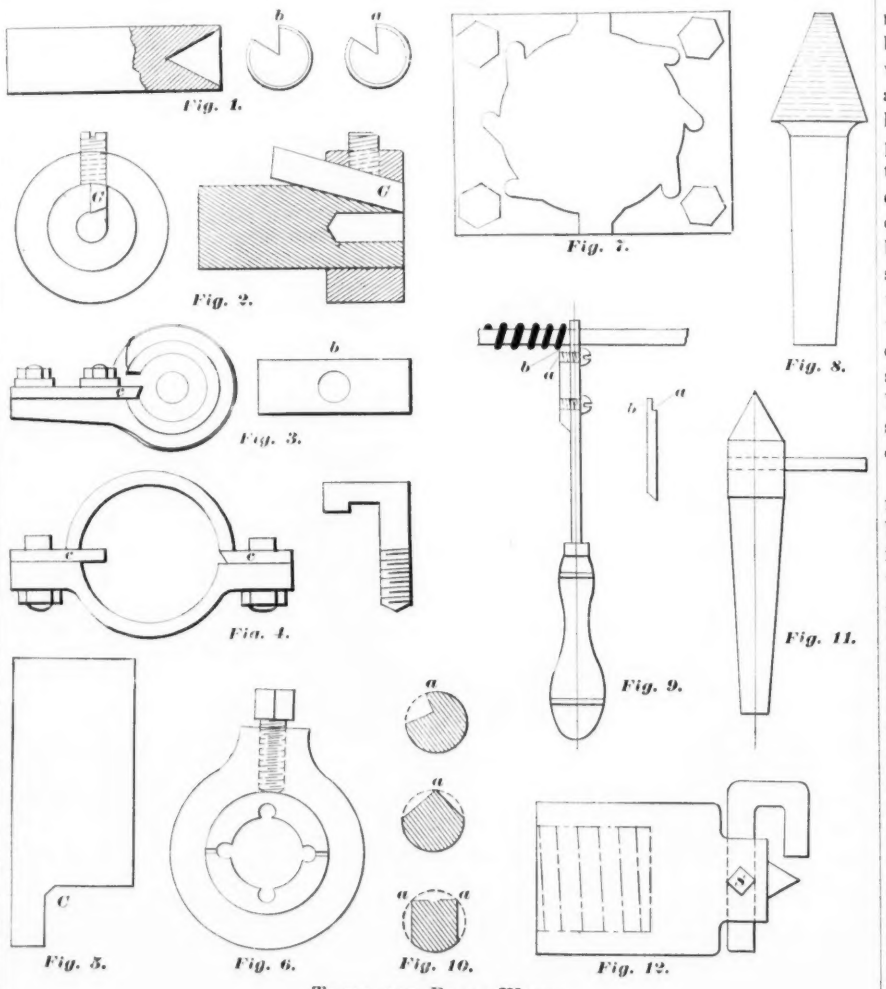
The piston valve is popular in this type of engine, and a semi-balanced plain slide is also used. In nearly all the high-speed practice, except that of Mr. Porter, the valves are driven from an eccentric, which is moved across the shaft by a governor, in a direction that changes its angular advance, thus determining the point of cut-off; this same eccentric also indicates the steam release and exhaust closure. This type of engine is commonly known as the single-valve automatic, so called from the fact that all the valve functions—admission, cut-off, release and exhaust closure—are performed by one valve.

The Buckeye engine, one of the earlier of the quick-running class, is also of the shaft governor brand, but differs from the others in having one valve for admission and exhaust, and a separate one under the influence of the governor for cut-off.

Tools for Brass Work.

By Fred H. Colvin.

As it is the small tools that go to make up the shop equipment for much of the work, and as the cost of production depends on these as much as on the larger tools, it will be to our interest to consider them still further. To the tool maker in the large and well-equipped shop it is not difficult to construct tools or other devices for the work in the most approved style, for he has every facility for doing all kinds of work with little trouble and expense. But the man in the small shop is not so fortunate, and must devise means of accomplishing the desired end in the tools, as well as in the work they are to perform. This is often the hardest part of the work, but a skilled man is not apt to be balked by any ordinary obstacle, and the training that these small shops give a man is of great value in after years.



Tools for Brass Work.

For small screw work there are numerous devices in use to facilitate the production at the least cost. Before going farther it may be well to say that it is not intended to deal with the tools and devices of the monster shops—shops where the different sizes of screws are made by thousands—but rather the medium-sized brass shop where the work is so varied as to make it unprofitable to fit up for all the different branches in the manner of large shops. There is no doubt as to the economy of having the best tools for all work where the quantity is sufficient to warrant the expense, but where the work is small in quantity, and of great variety, it is advisable to make the tools as cheaply as is consistent with good work.

Where it is possible to buy the parts of these large manufacturers, it is folly to attempt to make them, but it very often happens that the parts required are not a commercial article, and it is these cases that are dealt with in these papers. Self-opening dies, and such tools, are of great value in places where the quantity is large, but would hardly be profitable in the small shops, as the number required would not be large, and the time they would lie idle would represent too much idle capital.

The case in question was to make small lots of ⅜ screws of special shape. There was to be a shoulder at a certain distance from the end, though it was of no great importance that this distance be exact. In fact, they were a kind of thumb-screw, with the butterfly handle, by which they were chucked. To chuck them with the least trouble, we had a holder made with a hole bored the size of the average casting, and by placing the screw end of the casting in the holder, the handle end was easily chucked true enough for practical purposes. We next chamfered the ends with the tool shown in Fig. 1, after which the milling tool was run over them.

The tool shown is simply a plain piece of steel, bored as shown, and a segment cut out for the formation of a cutting edge. To make a good cutting edge, the edge *a* should project toward the center, and to do this without the work of cutting the relief out of the tool, the following plan was adopted: The tool was made just as shown at *b*, and heated ready for hardening. When it was about hardening temperature, the lip *a* was struck with a hammer hard enough to force the lip to a good cutting position; not a scientific method, perhaps, but one that has proved efficient in practice.

For the milling tool on this small work, the form in Fig. 2 is used, and found to answer all requirements. In practice both ends are utilized, each being fitted for different sizes, and the collar and milling tool changed from one end to the other.

The two views of the arrangement will show its construction very clearly, the cutter *c* being, as in nearly all cases, a piece of bar steel cut from the commercial sizes of steel. They are cheap, and do all that is required of a milling tool on this work. For the die we use an adjustable collet die that has stood the work for about eight years and is all right yet.

The form of milling tool shown in Fig. 3 (but shown left-handed by mistake), is cheap and effective for larger sizes of work, from ¾ to 4 or 5 inches, or even larger. By using bushings they can be used for various sizes, although if there is much work of the same size, it will pay to have separate ones for each, as they are not expensive to make. They can be made with holes for cutters in the center, to bore the inside at the same time, securing the bore true with the outside. In larger work it has been found better to have two wings to the tool, and use four cutters instead of two, keeping two sizing the work just behind the forward or roughing cutters. The tools, which are pieces of bar-steel, as usual, are held in place by clips, which are equally cheap and effective. The one shown in *b*, Fig. 3, is a piece of bar-iron or machinery steel, cut off to the required length, drilled, and it is ready for use. For work having a special shape and size, and made in quantities, it is best to have a milling tool for each size; and in the smaller work, the holder shown in Fig. 3, with the cutter in Fig. 4, will be found well adapted. This mills, chamfers and faces with the same tool, and is sharpened by grinding the face, as in many forms of tools, gear cutters, for instance.

While speaking of milling tools, it may be well to show some of the different kinds, even though they are not the approved style. Fig. 5 is used by some with apparent success, but costs more than the styles shown, and requires special clips for holding the cutters—at least special clips are used. The cutters are on opposite sides, one for milling and the other for facing, chamfering being done with a hand tool. One cutter would do the work and save setting, as well as the hand-tool business. This hand tool is not good practice where it is possible to avoid it, and it usually is; the tools can be so made that no such hand chamfering will be necessary. The beauty of the one-tool system is that the lengths can be kept the same without depending on the setting of the different tools; different men vary in degree accuracy, and that means variations in the work. In shops large enough to warrant it, all the tool setting and sharpening should be done by one man, or by those competent, for more tools are spoiled by injudicious grinding (I will not call it sharpening) than in any other way.

Any quantity of designs for milling tools might be shown, but, as has been remarked before, the work to be done is the best guide in selecting the form to use, and knowing the principle of several styles, it is easy to design one for the particular case in hand. Dies attract a large share of attention in this kind of work. I will show two styles that are much used, not recommending them, however, as equal to the styles shown in my first paper on the subject. Fig. 6, which shows the end view, will be sufficient to give the idea of construction; it is what is often known as the split die, being adjusted by the collar and set-screw as shown. It is made by boring and threading the inside, and then screwing in a plug, while the holes at the side are drilled, the plug preventing the drill from "running."

It does its work very well, but is an expensive die to make, and cannot be sharpened except by drawing the temper and filing. This reheating and tempering is hardly an improvement to the steel.

The next cut shows what is known as the plate die, and has little to recommend it. It consists of a holder made as usual, and the die made of a plate of steel bolted to the face of the holder. The dies are expensive to make, and are very apt to spring in hardening. They have to be adjusted by moving the whole half-plate, and then depend on the set-screw to keep them from slipping, and the cutting is all done by the middle teeth as soon as they are adjusted smaller than the circle they were bored to; in fact, there is little to be said for them and much against them. In designing anything of this kind it is well to remember that sharpening is an important article of consideration, as well as the question of replacement, and any means of adjustment that alters the shape or form of the cutting parts can hardly be desirable.

Leaving turret work for a while, we will consider some attachments and handy tools for hand or Fox lathe work. For repair work there is often need of some means of holding washers or nuts that are odd in thread as well as size, for which there are no chucks, and which need not necessarily run exactly true. For such work there is no

handier tool than the center shown in Fig. 8—an ordinary cone center, with a fine thread cut on the cone. In use, the article to be turned, or just cleaned, is screwed on sufficiently to hold for the time required, and the work done with no delay for making a chuck to fit the special size. The thread, being fine, does not injure any ordinary work, and the time saved will be appreciated by those who have not used this kind of center.

While speaking of Fox lathe work, the carrying chucks, shown in Figs. 11 and 12 may be described. The center in Fig. 11 will need little, if any, explanation, being merely a center with a projecting arm or pin to carry the work. This is useful in work where forked articles are to be turned, the forked portion being placed around the center, the pin driving the work. Some use a forked center for this kind of work, but we have found this to be superior to that form. Fig. 12 is much the same principle, but in the form of a master chuck to screw on the lathe spindle. The carrying arm is held by a set-screw, as will be seen from the cut, and can be adjusted at will to any desired position, in this way accommodating a variety of work. If it was desired to use an ordinary lathe center in the chuck, the arm might be held in the chuck body so that it would not interfere with the center by being placed in the body of the chuck parallel to the center.

There is a variety of ways for winding springs—ways so numerous that to enumerate all would take too much space, and be of little use to any one, but there are two methods which, though similar, are worthy of mention.

The first method consists of winding the springs on a rod as long as will go between centers of the lathe, and winding the rod full, using the screw feed to regulate the pitch of the spring. In this way you can wind several feet of springs at a time, and cut them up into the desired lengths as they are wanted—a decided improvement over the method of winding each spring separately (which, by the way, is done even now in shops where they ought to know better).

But the best way for ordinary shop practice that the writer has seen, will be described with the aid of Fig. 9. The credit of this method, as far as known, is due to Messrs. Brinton & Denny, knitting machine manufacturers in Philadelphia, and was devised to wind a whole reel of wire at a time. In some cases the hole through the spring is not over .05 of an inch.

Using a hollow spindle lathe, the rod that forms the mandrel is fastened in a chuck, and the end of the wire fastened in the chuck with the wire. The rod passes through the tool shown in Fig. 8, and the end of the wire through the opening *a* (shown more clearly in the separate sketch of the clip). The thickness of the point *b* determines the pitch of the spring, and it can be used without this clip when it is desired to wind, so that the coils are as close as possible, in this case the tool being used to keep the coils close together by a slight pressure against the coils already wound. In ordinary winding, however, the tool rests on the lathe shears, or against them, and is fed by the point *b* acting as a nut in a screw thread. After the rod is wound full, the lathe is stopped, and the chuck jaws loosened, the coil wound is pushed through the hollow spindle, and the chuck being again closed, the same operation is repeated until the whole coil of wire is wound. During the operation the coil of wire is held upon a revolving reel, and fed with the least possible trouble. It makes the operation very simple, and the convenience of having the whole coil of wire wound and out of the way must be tried to be appreciated, and as the springs are cut off as wanted, the waste is reduced to a very small fraction of the usual amount. The wooden handle is very convenient to hold when winding the close coils, and does not hurt the lathe shears when it rests against them for regular winding.

In Fig. 10 are shown a few sections of reamers for different work. The cutting edges are shown at *a*. For small work, where there is little to be cut away, either of the forms will answer very well. For ordinary work, however, the teeth should be made with a freer cutting edge, and, what is equally important, should be few in number, to facilitate grinding.

Some tool makers seem determined to put as many teeth as possible in a given size reamer, and when it comes to grinding, it is anything but pleasant, oftentimes requiring drawing the temper and filing to the required shape or sharpness.

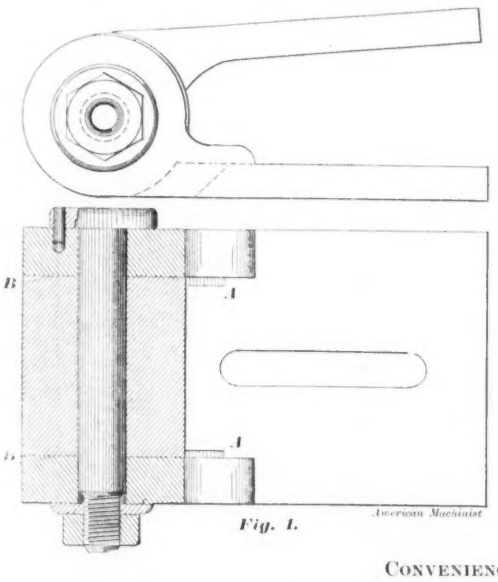


Fig. 1.

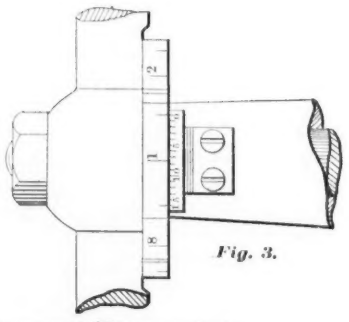


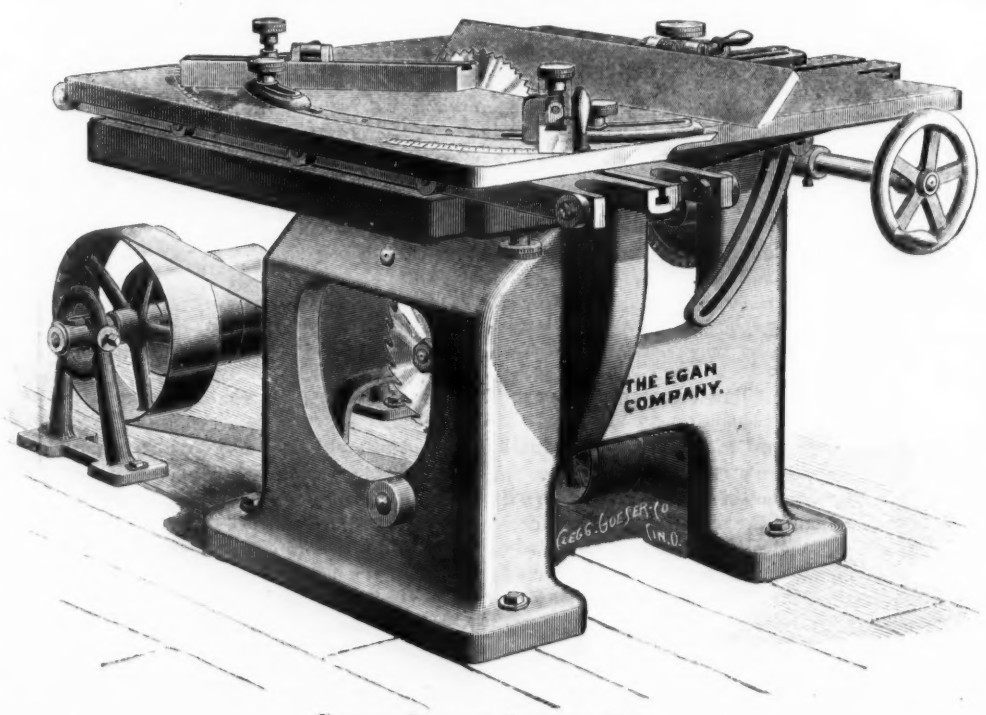
Fig. 3.

CONVENIENCES IN THE MACHINE SHOP.

Double Rip and Cross-cut Saw.

The accompanying illustration is of a machine recently brought out by the Egan Co., Cincinnati, Ohio, and designed for general work, and especially for pattern makers' use.

The frame of the machine is in a single piece to give rigidity. The saw mandrels are arranged to revolve around a common center inside the column, so that when the ripping saw is above the table the cut-off saw is below the table; and for grooving either saw can be brought above the table, according to the depth of groove to be cut. This is accomplished by the well-known principle of mounting the saw arbors in a frame, which is in turn mounted upon trunnions so that it can be rotated to bring either saw to the top by means of the hand-wheel seen at the left, which is on a worm shaft, the worm gearing serving not only to adjust the saws to the proper height, but also to hold them in any desired position. The table is of iron, made in two sections, both sections planed true, and the one at the left of the saw made to work back and forth on rollers for edging or cross-cutting. There are two miter fences for cutting right and left, and one ripping fence, all accurately fitted to the table, and in line with the saw. The mandrels are of the best quality of steel, running in self-oiling boxes lined with best genuine babbitt, and driven from a countershaft placed clear of the column. The first one of these machines was built for the U. S. Navy Department, its excellent work leading to its being regularly made for the market.



DOUBLE RIP AND CROSS-CUT SAW.

We understand that Jesse L. Law, Sr., who has for some years been connected with the Garvin Machine Company, has accepted a position with the Niles Tool Works, who are to open a large machinery depot corner Liberty and Washington streets, New York.

The dock laborers in England, in their recent strike, seem to have met with a rather crushing defeat at the hands of the Shipping Confederation. A point was gained here and there, but nothing of consequence was gained in a fight that must have cost many thousands of dollars.

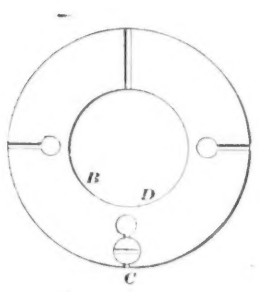
Conveniences in the Machine Shop.

BY A MECHANIC.

Drilling operations in most machine shops will allow of great improvement. First by using jigs as far as is practicable, and then by proper conveniences for holding work. I have never seen drill presses supplied with proper rigging. For many jobs of drilling we need something like such rigging as is used on the planers, but we never see such rigging, and I would like to know why. A few years ago a new Gould & Eberhardt drill press was bought, and set up in the shop where I was working. I noticed that there were pins or hooks cast on the machine for holding bolts by the head.

As in this shop they were not in the habit of keeping any bolts around the drill presses, I was somewhat interested to see if they were going to take this good suggestion.

I did not see any one "catch on," and I don't think to this day that these pins have been introduced to a bolt of any kind, and more than this, there is not a decent set of drill collets in the shop, or a good drill chuck that can be used on this drill press. Good machine tools can't be appreciated without proper conveniences to go with them. I believe that a firm that can afford to buy good machine tools can afford to supply conveniences for use on them, so the reason must be insufficient thought, or in other words—neglect. I believe it would be a profitable move if there was some system established in shops in regard to this matter. Probably it would not be necessary to have complete rigging for each machine. There should be good bolts arranged the same as for the planers, also good straps, knees, jack-screws, V blocks, parallels, grips, center, set of collets, and a good drill chuck. These things should have places provided for them near the machines (not in the tool-room), where they can be kept clean, and above all it should be somebody's business to see that these things are kept in their places and *clean*.



In Fig. 1 I show an adjustable knee, which is useful often for drilling and also for planing. I would make cuts as are shown at *A A* for the purpose of weakening the casting at that point so as to allow of clamping. I would also counterbore or scrape a little clearance at *B B*, so the contact will be sure to come on the largest diameter.

In the AMERICAN MACHINIST of Aug. 21st, '90, I gave a scheme for a graduated dial for drill presses. Some such plan is a great convenience in the machine shop. In the factory a "stop" is a better plan, for there workmen are not supposed to think. There is some one else furnished for this purpose, who sets the machines, and so the workmen are only expected to furnish the automatic part till they get things better perfected, and then they will dispense with him. I say it is better to have a stop for the factory, and it is best to design this "three times stronger than nice," letting nice be the limit of the strength of a human being, then when the stop should act it is pretty sure to do so. In the machine shop the workman is supposed to think, and he is not expected to let his hand pull his common sense around much. In the machine shop a machine is not used to drill similar holes under the same conditions for many months without a "let-up," and so many times it would be more bother to set a stop than to get along without it.

Some establishments run both machine shop and factory, and some of these places seem to know a great deal more about managing the factory than the machine shop,

and so it is amusing sometimes to notice the way things drift around. As I said before, the factory plan is to hire "hands" to do the pulling around, and confine the "think" to another department. Now when they undertake to apply this plan to the machine shop the fun commences. If a "hand" is started at drilling ½-inch hole, perhaps in five minutes it is done, and then he applies to the think department to be started again. This makes the think department very busy, and so from time to time they have to increase the force. After a little while the think department will outnumber the other, and then, perhaps, the manager will "catch on" to this very bright idea. Let the man who thinks, not only think, but pull too, and, if necessary, pay him both men's wages. Now, this factory manager has completed his circle of "improvements," and has got right back where he started from. He could have gone into grandfather's shop, and learned this on the start. The long and short of it all is this: It is just as sensible to pay one man to think as another, the conditions remaining the same.

The old suspension drill, I believe, was a good idea, but improperly worked out. I think somebody recommended a radial suspension drill in the AMERICAN MACHINIST quite a long time ago. I think such a machine could be made so as to be very satisfactory. There is this good point about the suspension drill—it has a range that is only beaten by all out-doors. Radial drills, any way, are far superior to the common kind for most drilling operations in the machine shop.

The portable drill press has its uses, and I believe in connection with this that electricity is destined to play a part. Perhaps not play, but pull. The advantage of electricity for this purpose lies in the convenience of conveying power to the drill. When electricity is used more for light in the shops perhaps it will be used for this purpose also. Electricity would be a good means of conveying power to the spindle of a radial drill, for it would do away with a large amount of gearing, and so cause less vibration. The wires could trail from the ceiling, and would not interfere with any movement of the arm or slide.

In the issue of Aug. 21st I gave a scheme for graduated dials for lathes. Since then I have had more experience with such things, and being more convinced of its convenience, I am tempted to speak again. In Fig. 2 I show a plan that has been in every-day use for a long time, and to say that it is a convenience is to say very little. The cross screws of these lathes are 8 pitch, and so 8 divisions give us 64ths. I use the plain friction calipers, and just round the work so as to caliper it, then take the size from the calipers with a scale; I then know how much is to come off by 64ths, and I find I can guess for finer points, so that I find it safe to come within 3 or 4 thousands of the size, the first try by this means; this helps, but this is not all its uses by any means. It is useful for setting the lathe for tapers, for setting the lathe straight, for screw cutting, for boring holes and recessing them. We can rough out a taper hole by its use, and do lots of things "too numerous to mention." The pointer shown at *A* is only a piece of sheet brass bent around so as to have enough friction on the sleeve to keep it in place. This plan is so simple and good that it has tempted me to try again. I believe the dial should be the adjustable part.

My design is shown in Fig. 3; a side view of the dial is shown at *B*. This, if the screw is 8, I would divide the same as Fig. 2. I would turn a journal on the hub of ball crank to fit hole in dial tight, and after graduating the dial I would split it as is shown, so that the splits would come between graduations. The screw shown at *C* is only for adjustment in case of wear, and might be left out. The idea of this is a taper screw so as to spring the piece at *D*, and so close the hole a little. The pointer I would make graduated in 15 divisions, as is shown, so as to divide the 64th division into about thousandths.

The "Caldwell" Water Tube Boiler.

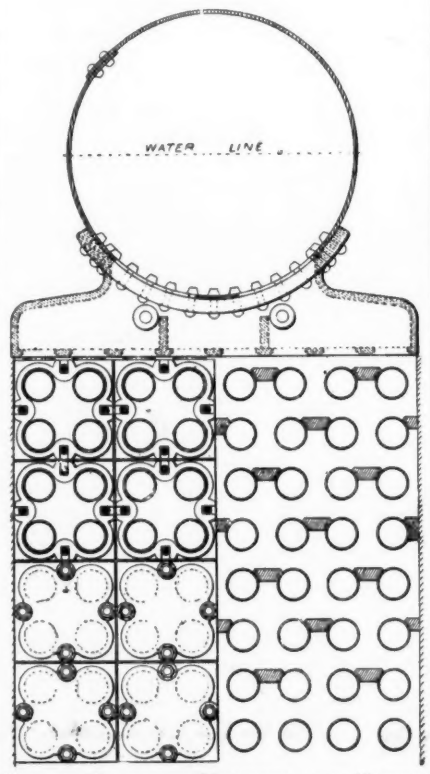
Our illustrations on this page show the construction of a water tube boiler called "The Caldwell."

Our readers are of course already familiar with the advantages claimed for this particular type of boiler, *i. e.*, rapid, thorough circulation always in one direction, so that conflicting currents are avoided; great strength and freedom from danger of explosion, owing to the comparatively small size of the tubes exposed to the fire; superior action of the fire upon the tubes, owing to the fact that it is made to pass and repass over and between them in a direction nearly at right angles to their length, accessibility for cleaning, repairs, etc. It remains only to speak of the special features of this particular specimen of the general type.

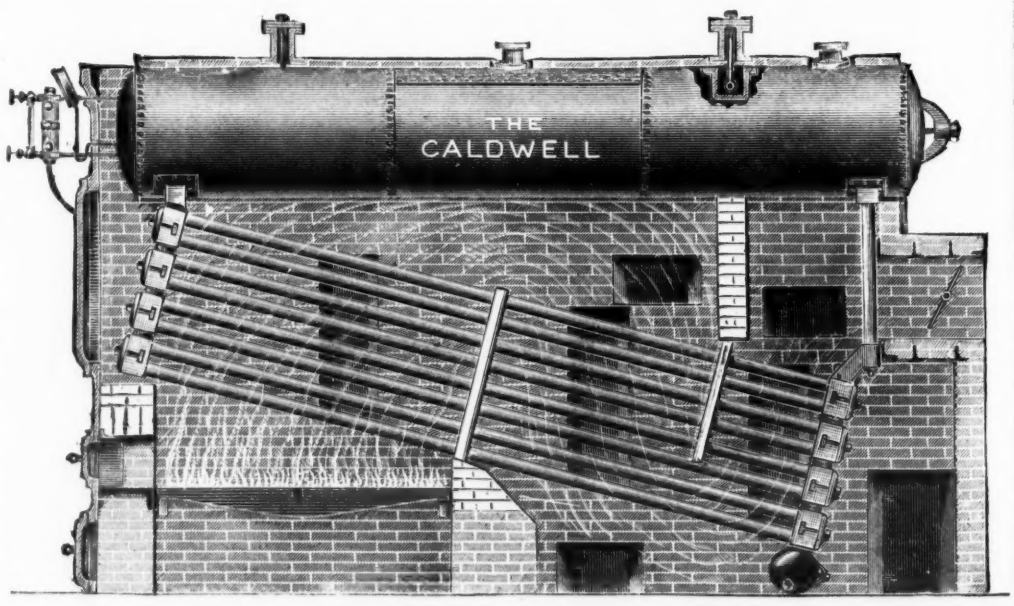
The header castings are quadrangular in shape, each section or box receiving four of the tubes, which are 4 inches diameter, expanded into holes which are bored and reamed to uniform diameter by special machinery. These heads are then connected together by 4-inch nipples in such a way as to allow a large and straight passage for the ascending or descending current of water, and also to allow for whatever inequality of expansion there may be between different tubes without straining any joint, it being assumed that the four tubes which make up any one section will be expanded practically to the same extent, because subjected to practically the same heat.

The cap or cover which goes over each header is held in place by four steel bolts having T heads, and fitted to pockets on the outside of the heads, so that no joints are necessary under the boltheads or nuts, and as they are given a factor of safety of 20 at a steam pressure of 100 pounds, accidents from their giving way are not to be expected, and in fact, if one of them should give way from any cause the result would be simply to allow sufficient springing of the cap to cause a leak, which would call attention to the trouble. The joint between the heads and caps is made by a thin piece of asbestos paper, and there is no screwed joint about the boiler. Removing one of these caps and examining the four tubes in that group will indicate the condition of all of them, and when necessary to clean them it can be readily done by the ordinary flue cleaner.

Each section or group of tubes is the duplicate of every other one, and by keeping an extra section on hand any section may be replaced by it at short notice should occasion require, without disturbing any other section or the brick-work. Or, any section may be removed and the boiler operated without it, simply by putting in longer nipples to maintain the connection between the remaining ones. Any tube can also be removed through the header without disturbing the header's position. Among the tubes are placed at intervals specially formed pieces of fire-brick called "baffle bricks," the office of which is to intercept the heated gases and cause them to take a more tortuous course in their way to the chimney, and thus part with their heat more thoroughly, and also to absorb heat when the fire is at its hottest, to be given out when it is new, thus helping to maintain even temperatures of the tubes and comparative freedom from contraction and expansion, and an even rate of evaporation.



FRONT VIEW OF HEADERS AND BAFFLE BRICKS.



THE CALDWELL WATER TUBE BOILER.

The fronts of these boilers are also made in sections, of wrought-iron with cast trimmings, the boiler being thus comparatively easy to transport even to places difficult of access, and repairs are also comparatively simple. In a 100 horse-power boiler of this make the disengaging surface is 51 square feet, and the steam space 60 cubic feet. The builders are The Caldwell Water Tube Boiler Company, 18 Cortlandt street, New York City.

A Novelty in Propeller Screws.

A Baltimore special dispatch to the *Tribune* says:

Shipbuilders and marine men will this week be permitted to inspect the strange-looking new steamer "Howard Cassard," which Mr. Myer, the inventor, asserts will revolutionize ocean travel. The shaft and propeller will be adjusted, giving the maritime people an opportunity to see in place a four-bladed screw, each blade of which is set on a different line of rotation, or in spiral order, increasing in pitch toward the stern, as compared with preceding blade or blades. The object is to embody in a single screw as much surface as now exists in a twin-screw driven by the same amount of power. The inventor asserts that this feature of the vessel is an experiment. The "Cassard" will soon receive the finishing touches to make her ready for the dock trial, which will take place about April 15.

In the description of the Henderson triple-expansion engine, in our issue of March 19, the fourth paragraph from the beginning, commencing "Side thrusts of the pistons," etc., should have been omitted. It does not belong with the description. The particular feature referred to has been patented by Mr. Henderson.

Steel.

BY S. W. GOODYEAR.

I wonder if it ever occurs to those who advocate the use of some old-time imported brand of steel as the only reliable thing for certain uses, to ask how it is possible for some of our neighbors to use, for the same purposes, American steel exclusively. What have they to say to such testimony as this? Said the manager of a concern where the most important item in the supply account is that of steel for dies, and hardened rolls: "No, sir, we don't use any American steel; I don't care to try it even. For dies we use ———'s steel. For rolls we use ———'s regular roll steel, and feel satisfied we are using the best thing for the uses to which we put them that it is possible to get." He had named the steels which are considered standard for the above uses.

Later, said the same man: "The result is surprising! Both the dies and rolls are entirely successful, and, curiously enough, the dies have stood to produce twice as much work as the best pair we ever had in the works from the old standard imported steel, while the rolls are still in good shape, and have done three times as much work as we ever did with a pair from the imported steel, which we formerly thought was indispensable."

What caused this strong language to be used? Simply this: He had been induced to try some dies and rolls from American steel. You who so strenuously uphold the superior virtues of imported steel, and so strongly condemn as practically worthless all American steels, please analyze this. Here was a concern the very foundation of whose business rested upon the use of hardened steel dies and rolls, with an experience of many years in handling certain popular imported steels, the names of which are as familiar to all steel workers as are the names of Pratt & Whitney and Brown & Sharpe to all machinists. Certainly in all those years it must have been learned how to treat the steel properly, or at least some of it should have been put at its best through accident, and still, here was the first pair of dies from American steel, against the disadvantage of being hardened by a party unused to any but the old "———'s warranted," made for themselves a record of twice as much service as any pair of English steel dies ever used in the works! "One chance against thousands, do you answer, "and one case. It was only a sample. Let them try to get some more like it." They did, and got it, and are using it, to the exclusion of imported steel, and it is not one case, but hundreds, aye, thousands of cases where the sample bar, of which you speak as a "bait," has been duplicated, and after months and years of continued use right alongside of best imported steel, American steel has been adopted exclusively by men as intelligent as yourselves, who do just as good work, and as much of it, why not look at the question from this point of view? Surely you cannot look upon these men as lacking in sense, or as being willing to permit their patriotism to deplete their pockets?

What have you to say of the decision in

favor of an American steel where there were the questions of strength, both hardened, and in natural condition, as well as of cutting qualities, to be settled by careful and comprehensive tests? Although there were several of the most popular imported steels included they were all beaten at every point by the successful American steel, which has since held its place against all others with the concern who made the tests, and who work up hundreds of tons yearly for tools into which they intend to put the best steel to be had, regardless of price.

What about a case in which, after repeated trials of the old standard English steel, which its admirers say, "is good for all uses," it was decided that for a certain use it would not do, and so, with a full description of what was wanted, "some were ordered out, to be made on purpose," which failed as signally as had that from same brand out of stock, and then an American steel, at half the price, fully filled the requirement the first time trying?

It is, of course, a very easy matter to say, "There are no steels, no drill rods, no fine files, no gravers, made in this country to compare with those of popular foreign brands." But with the facts before us that they are made, and used by the millions of dollars worth yearly for all the uses to which the imported goods are put, and with equally as good results, even better results in many cases, is it not time for some of those who can see no good in home productions, for their own use, to at least treat the opinions of others, equally capable of judging, with respect? Why not look into the matter of steel making intelligently, and ask yourselves: If steel be made *here* of suitable iron, Swedes iron, if you please, by most approved English methods, why should it not be just as good as though imported? "Unwarranted assumption," do you say, "that Swedes iron enters into the make up of American steel, or that, practically the English and American methods are identical"? Well, then, if you will investigate you can find that millions of dollars worth of Swedes iron has been put into steel in this country, and of as good quality, and as well adapted to steel making, as that used by foreign steel manufacturers; and further, that some of the most successful American steel manufacturers have had, as leading men in their steel making proper, English steel makers, who, when "hat 'ome," made your own favorite "reliable, infallible" brands. Does it look reasonable that the product of their labor, when in England, should have been so good, and now that they are here should be worthless?

Do I realize what I have been saying? Do I believe that American steel is better than the old standard brands? I did not say so. I am not prepared to say so. But I do say it is as good, and that for any purpose whatever for which steel is used, there are none of the imported steels which cannot be fully equaled by that of home production. But I stated cases where American steel had doubled, even trebled, in service, the best service of imported steel. Why? Simply because the particular steel used of American make was better adapted to the use than was the imported, from stock.

There is this difference between using the imported steels out of stock, and using a steel made here: If anything goes wrong with your English, or other imported steel, you go back with it to a dealer who only knows about steel as an article of merchandise, and who replaces what you complain of with more of the same sort. The manufacturer is too far away for you to complain to him, letting him, through your representation of the difficulty, change the grade or temper to suit your requirements, which is what you can do, and would be likely to do, if using American steel. Do you say, "We don't believe in so many different grades of steel for different uses; we use ———'s regular, out of stock, and it is good for everything—lathe and planer tools, milling cutters, taps, drills, reamers, cold chisels, rock drills, cutting and stamping dies, drop forging dies, dies for heading, hot or cold, etc.—one bar, if of suitable size, will make any or all of these." I heard a man say just this. Later, I have heard the same man say of tools from American steel, which he had been induced to try: "Good? Why they stand to do work which we can't do with any other tools in the shop! Never had such tools before!"

But perhaps I have said enough for once, and will wind up with this advice: When the steel manufacturer asks, "To what use is this steel to be put?" don't get mad, and tell him "It is none of his business," but take him into your confidence, and let him fit you, for to be fitted in steel is of as much importance, and as susceptible of accomplishment, at the hands of competent men, as is the fitting of boots.

A fair idea of the difficulties in the way of establishing facts in the line of steam engineering may be had from the difference in the opinions of engineers as to the utility of the steam jacket. The burden of opinion is, that under some conditions, the steam jacket is advantageous, but just what these conditions are is not known with any degree of certainty. When what is apparently good sound theory would point to its economical operations, it appears frequently to be the reverse of economical, and where there ought to be no especial advantage in its use it as frequently saves fuel. There are a good many unsettled problems in steam engineering, and the use of the steam jacket is one of them.

Double Surfacer, Matcher and Molder.

We give on this page an illustration of a machine built by the Indiana Machine Works, of Fort Wayne, Ind., and which they call their No. 2½ double planer, matcher and molder. It has been designed with special reference to the requirements of those whose work calls for a machine capable of doing a wide range of work, and with adjustments easily and readily made to suit any work coming within its capacity.

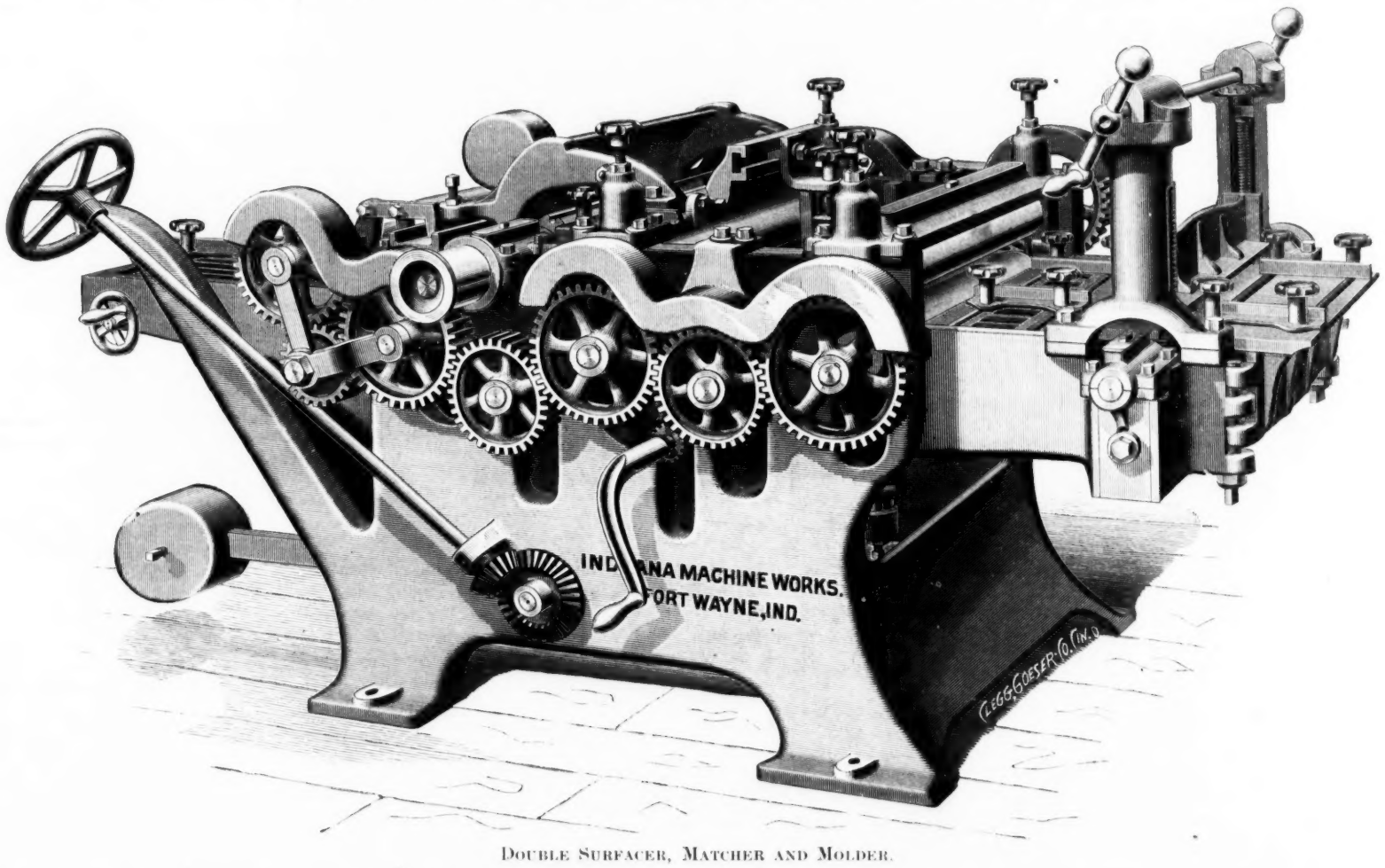
The frame is cast in one heavy and massive piece, securing for the machine that rigidity unattainable where it is sectional. The table is cast in a similar manner, is very long, and provided with a heavy platen, placed immediately under the top cylinder, which, being removable, will admit of the sliding surfaces being trued up in the event of uneven wear by service, without having to disturb the table proper. The latter is adjustable with matcher heads in bearings 12 inches long by 26 apart, by two heavy screws, centrally located, and controlled by a large hand-wheel, placed in convenient reach of operator, all so arranged as to make the duty of elevating the table to the desired position a comparatively light one.

The top cylinder is made of a crucible steel forging, has large journals, is driven by two belts, is slotted on two sides, tapped on the other sides, and, as the machine is provided with adjustable pressure bars, cutters of almost any description may be used at any desired point, projecting any distance beyond lip of cutter head, not exceeding 1¼ inches, without removing any of the fixtures just mentioned. The lower head is made of same material and same manner as the upper, except that it is driven by one belt. Its bearings are large, and fitted into planed surfaces, thus admitting of a vertical adjustment. The pressure shoe is very stiff, and may be quickly adjusted from either side of machine. The end of table is very substantial, and swings on a heavy hinge, furnishing free access to the head.

The six feed rolls are large, have substantial bearings, are all powerfully geared, the gears being cut from the solid, and controllable instantly by a belt tightener. There are two rates of feed, namely, 35 and 65 feet per minute. The front feed roll is weighted, keeping a uniform pressure on roll, no matter how great the cut to be taken.

The matcher spindles are of large diameter, made of refined steel, and revolve in long self-oiling bearings, with provisions to compensate for wear. Three winged gun-metal heads, with milled bits, are furnished, or, if preferred, shimer heads will be substituted. Said heads are adjustable separately or together, from either front end of table or side of machine, the guide fence moving with the head on the same side of machine. The spring holding lumber to guide is also controlled by hand-wheel, and may be placed in any desired position almost as quick as it takes to tell it. When matcher heads and other fixtures are removed, planing to the full width of machine may be done. These changes are quickly and conveniently made.

Altogether, the machine is of such a character as will commend itself to those engaged in the line of work it is intended for.



Double Surfacer, Matcher and Molder.

Four men went into a naphtha still at Williamsburgh, N. Y., to do some repairs. The still had been emptied for the purpose of making these repairs, and some one had, so it seems, given orders to have it cleansed of gas, but the order had not been carried out. After the men were in the tank, an effort was made to light a lamp, the result being an explosion, from which three of the men died within a day or two. There is nothing remarkable about the fact that the explosion occurred. It would have been remarkable had it not occurred. The only strange thing is, that the men, who it appears were experienced in such work, and knew all about the danger, should have entered the still until they had satisfied themselves, by means of throwing in a lighted torch, that there was no danger of an explosion. After all, perhaps this is not strange. For it is generally the case, when workmen get injured while at their work, that it is those who know all about the danger, and hold it in contempt, as it were.

LETTERS FROM PRACTICAL MEN.

Holding Thin Pieces of Work—Electric Motors.

Editor American Machinist:

The accompanying sketch illustrates a good way of holding thin pieces in a planer or shaper so as to plane them perfectly parallel. We will call them "hold-downs," for convenience. They are pieces of steel about one-quarter inch thick, one inch wide, and five or six inches long, planed wedge-shape to about $\frac{3}{32}$ on one edge, and each edge beveled about one degree as shown in sketch at *A*. They should be hardened to prevent wear; when put in the vise and tightened up; owing to the beveled edges they tend to draw the work down firmly on parallel *B* or bottom of vise. I think by giving them a trial every tool maker and machinist that has not used them will find they are a valuable acquisition to his kit of tools.

In response to J. K.'s question from Seattle, Wash., in AMERICAN MACHINIST, issue of January 22, Question No. 41, who desires to know if electric motors have been used to run foundry fans and rattlers, I will state for his benefit and others that electric motors have been used at the Edison Phonograph Works, Orange, N. J., for the past three years, and have given entire satisfaction.

J. G. K.

An Industrial University.

Editor American Machinist:

I have been very much delighted with the article by my friend, Prof. Sweet, in the AMERICAN MACHINIST of March 12th, and it seems to me he has struck the nail very square on the head, in saying that the great need of the day is not "a college with a machine shop attachment," but "a machine shop with a college annex," or a number of them.

I have read his article over carefully twice to see if I could find anything to criticize, and agreed with him more fully after the second reading than I did after the first one.

The only point which I can find on which to differ from him is that of depending at all on tuition fees, or premiums, for the support of the institution. The endowment should be ample for all such purposes, and I have no doubt that we have living amongst us other Cornells and Vassars yet unknown, who, if the question were clearly placed before them, would freely contribute from their surplus hoards for such a purpose. Take such men as the late Mr. Fayerweather, for instance; who can question that in the distribution of his millions among the colleges, of which the New York papers have lately had so much to say, he would, had he known of the real need of it, have set apart a share for a proper mechanical school?

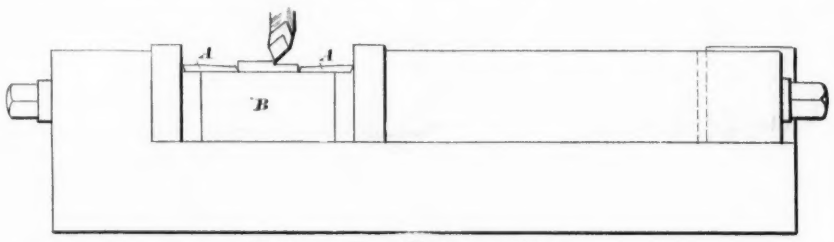
And I do not mean such schools as we now have, for there are plenty of them, good as they are, but such as Prof. Sweet suggests, where a boy can not only learn theoretically what to do, but practically "*how to do it.*"

My own mechanical training, fifty years ago, was a somewhat desultory one. Shop training was mixed up with laboratory experiments, and while Milton D. Whipple, a townsman and colleague of Thomas Blanchard, of gun-stock lathe fame, taught me how to handle a file, and cut and lace a belt, I learned a good deal about nice work from an old Lancashire mechanic, Thomas Atherton, the father of A. T. Atherton, of the Potter & Atherton Machine Co., of Pawtucket, R. I., and Dr. Samuel Dana, the chemist of the Merrimac Print Works, at Lowell, called me in to his aid in making records of boiler tests. I will not detail my own experiences; they are better fitted for a chapter on "Formative Influences" in the *Forum* than for the purpose for which I am now writing. Suffice it to say that "I got there in time," after a fashion, so that when my sons left school, and wanted to learn mechanical engineering, I told them to go into the shop and learn the practical part of it by day, and I would be 'the Professor" in the evening. The result has proved entirely satisfactory, and now I come to the point, which is this: There are very many bright boys with natural mechanical tastes and abilities, whose parents cannot afford to pay tuition fees, and support their children during the three years, which I conceive to be the shortest time in which even a bright boy can acquire any sort of a practical mechanical education. A large city like New York, Philadelphia or Boston, where boys abound, is hardly the best place for such a "shop school," and if it were located in such a place as Lowell, Worcester, or Syracuse, there would be the additional expense of board-bills for the boys, as well as the fees for tuition. The matter might be compromised in this way: A tuition premium for the first year, which would be all *learning*, nothing either way for the second, and a fair payment for the work for the third year, and an agreement that the pupils should complete a three years' course.

There should be a corps of competent instructors in each department—the foundry, the iron shop, and the wood shop—and a business head, who should control the finances, and sell the products in open market for what they were worth, not, however, attempting to undersell the regular shops making such articles as might be produced—small engines, machine tools, freight cars, or anything else which it might be desirable to teach boys to make so that they might learn the full use of tools on both metals and woods.

There are plenty of young men turned out of our various technical schools every year to fill all the branches of the engineering profession, but they aspire to something *else*—I will not say *more*—than to be skillful practical workmen, and there is room and call for half a dozen shops to teach the latter. The Trades Unions have broken up the old apprenticeship system practically, or so hampered it as to make it of no account; and if some of our millionaires, who have accumulated fortunes in the growth of our railway system, will hear the keynote which Prof. Sweet has sounded, and govern themselves accordingly, no better investment of a few millions can be made than in the endowment of half a dozen practical mechanics' schools, which shall each graduate one or two hundred skillful mechanics annually to meet the ever-increasing demand for that class of workmen in every State in the Union.

SAMUEL WEBBER.



HOLDING THIN PIECES OF WORK.

The Industrial University.

Editor American Machinist:

The constantly repeated assertion that the apprentice system is defunct will admit of some modification. It is a fact that shops have constant applications by intelligent boys of all ranks for places to learn the machinist trade, all willing to conform to the strictest rules and the lowest wages for the sake of an opportunity. Then wherefore are they excluded so persistently as they are admitted to be? Apprentices' work admits of a profit, as every shop proprietor knows, if intelligent boys are employed, and properly directed.

The obvious reason is that the large shops and corporations and trusts find it much more profitable to employ the boys as workmen, not apprentices, keeping them at the same machine continuously, and at which they soon become as expert as any machinist, but having no other resource they are compelled to work for half the wages of a machinist, whereas, in employing an apprentice, honesty and good faith are implied in the contract, and the boy has to be taught the various branches. In such shops advancement is out of the question, either in wages or variety of work, and $1 to $1.50 a day is about the usual salary. But it pays the company, and what are you going to do about it? There seems to be no doubt but the scheme of Prof. Sweet would produce plenty of machinists of the commercial college kind, if the product could be got rid of; but since this work costs next to nothing, it would probably sell in the same ratio, slaughtering the machine shops, and rendering worthless the trade they were trying to learn. This class of labor would seem to be equivalent to convict labor in its ruinous effects on the market. It doesn't seem a very encouraging prospect for the boys to be placed under teachers "selected from the ranks, whose sole qualifications are that they know how to do work, etc., in order to become good machinists (not engineers whose business it is to know how and why), but workmen who shall know how to do."

Inasmuch as this college shop is not expected to pay a profit, wherein is the incentive to do paying work, even by piece-work? And wherefore discharge a boy for failure, since it is only his tuition fee that is sought after?

This college is to be recruited from the upper class (financially) who are able to pay for their tuition, and require no wages. This is rough on the poor devil who has to start out in the world without a dollar or a friend, as the writer hereof has done. Blood is expected to tell, and partrician blood too, which the poor devil hasn't got, and hence, the Watts and Stephensons and Nasmyths and Corlisses and Howes and Sweets of the future are to be stifled in the cradle, as it were. Quoting further from Prof. Sweet, "Binding out their sons for a term of years is not an agreeable thing to contemplate for most parents." Of course not; but I object to the word and the process. Binding apprentices is barbarous and injudicious and unnecessary. A capable and ambitious boy is only too glad to stay his time out if treated decently, and any who run away are well rid of. It is not so much a question of getting boys to stay, as in choosing those who are worth keeping.

The greatest advantage of this college scheme consists in beating the trusts and corporations and trade unions.

C. W. CRAWFORD.

That Industrial University.

Editor American Machinist:

In Professor Sweet's article of the 12th inst., he seems to favor the "premium" system of apprenticeship. Would it not be an unjust discrimination in favor of the moneyed class. It doesn't necessarily follow that because a man has money he has brains.

There are plenty of men holding good positions—and capable of holding them—that haven't been "born with a silver spoon in their mouth." Had the "premium" system been in vogue they would have been barred out. It would create a "class apprenticeship on the '400' principle."

E. W.

Ten or Twenty Horse-Power Engine.

Editor American Machinist:

For every engine there is a certain cut-off which is best for that engine at a certain speed; increase the speed, and probably the cut-off may be made earlier, and vice versa.

G. G. asks a question which requires, to answer it, a very local and particular knowledge of the case. What, for example, is the cost of fuel now, and its probable cost during the next five years, and it would be impossible to answer his query without such knowledge, for there are fifty things to consider, including cost of oil, and, finally, the probable loss and inconvenience of making the change when the five years have elapsed.

The chances are that if a 10 horse-power engine be put down it will be made to do the work long after a 20 horse-power would be cheaper.

Should a 20 horse-power engine be put down at once, it would, perhaps, be cheapest to work it at maximum boiler pressure with an early cut-off and a partially closed throttle in order to gain the benefit of the superheating thereon consequent, and avoid the excessive cylinder condensation inevitable to a cut-off early enough to deal with full boiler pressure in an engine so much too powerful for its expected duty.

This, however, does not complete the possibilities of working. There are other methods which may be tried, one of which admits of the use of full boiler pressure on the piston, and a fair and proper cut-off, and, under the circumstances, it would appear reasonable to employ it.

This plan is to work the engine as single-acting only, with steam admitted say to the back end only. By so doing the cooling effect of the piston rod is avoided, as it alternately enters the cylinder or radiates in the air outside.

The front cover of the cylinder might, of course, be removed.

A serious disadvantage would be the cooling of the cylinder by exposure to the air. This would not, perhaps, be very serious where the piston was deep, as the portion of the cylinder exposed to steam might not be uncovered by the piston on the air side. This method assumes that the speed of the engine is such that the fly-wheel—of excessive weight for the power developed—would maintain a speed of rotation with one impulse only per revolution. Should it not be advisable to do this there is a plan of securing two impulses per revolution. Close the crank end steam port as before, and work single-acting only, alternately compressing and expanding the air confined in the closed end of the cylinder.

To secure this in constant action it would be necessary to provide a water escape for any steam which might leak past the piston and condense; an air inlet valve which could be set to draw air when the minimum pressure in the cylinder fell below a proper figure, as it might do by leakage; a safety valve of small size to relieve the compressed air should compression rise beyond a proper maximum. The action of the working fluids in such an engine would be thus.

The steam energy initially would be partially balanced by the inertia of the piston and other reciprocating weights, as is now so well understood, as to which see Mr. Torrey's articles on the subject. The compression of the air would be partially effected by the counter inertia of the same moving parts, and partially by the forward steam pressure and by the fly wheel, and the air thus compressed would give back its energy on the return stroke, and prevent that irregularity of rotation produced when there was nothing to give a push to the piston on its return, as in the first method proposed. Should the compression of a whole cylinder full of air into the small clearance space be too severe, a very simple remedy would be to insert a ring under the cylinder cover, so as to lengthen the cylinder in the case of the back end being the air end, and if, as suggested, the front end be for air, adding an air vessel with a good opening to the cylinder, so as to increase the minimum volume of compressed air. In no case should the compression be less than that necessary to overcome the inertia of the piston, etc., and give them a start on their way back so as to avoid a knock when turning centers. As regards the class of engine suited for this method of working, it would seem that the vertical type best offered itself as affording mechanical facilities for dealing with the question, the steam being made to act upwards, lifting the piston, which would thus by its gravity assist to equalize the energy put into the crank-pin on the up and down strokes; but I see no objection to the horizontal form. Of course the air extremity of the cylinder and any added air vessel should be protected

against radiation equally with the steam end, for the heating of the air by compression would be followed every stroke by a cooling expansion.

About the worst case of a too large engine which ever came to my notice was one at a paper mill in the north of England. It was a compound engine, and should have been worked with the small cylinder exhausting to the condenser, and the tandem low-pressure rod disconnected, for the diagrams of both cylinders were wholly under the atmospheric line.

If G. G.'s engine is condensing, can he also contrive to reduce the air-pump stroke, and so save friction on this detail?

It once occurred to me in connection with the question of too big an engine, that the closed end of the cylinder could be supplied with steam at a low pressure through a reducing valve, and pumped back to the boiler or steam pipe in the compression stroke, so as to give an impulse to the starting piston, and yet practically halve the engine power without any rejection of heat.

In any case, with a non-condensing engine it might pay to pump air into the boiler, as it seems to be a fact that a five to ten per cent. air admixture is an aid to the reduction of cylinder condensation, and so a means of economy.

It does not, however, appear probable that such contrivances can be made general or even reasonably effective, excepting in special cases where those in charge of an engine take particular pains, and spend time and trouble to secure the last shred of economy as a matter of pride and sentiment.

Engines are oftener overloaded than underloaded, and so there is not so widespread an incentive to adopt what may seem at first sight curious methods of obtaining economy, and yet I remember somewhere to have read a suggestion to fix the rate of expansion in an engine at the most economical point, and vary the exhaust closure to suit the power required, and if G. G.'s engine is yet to build he might have it contrived to do this, fixing the steam cut-off to six or eight expansions, and having an automatic governor controlled exhaust cut-off. (As I write, the Corliss or similar motion is in my mind.)

This latter method has the advantage that it admits of a gradual increase of the power of the engine during the five years, without any further alteration, and may be continued until the engine becomes loaded beyond 20 horse-power, when it would be necessary to let out the steam cut-off also. Much, of course, must depend on circumstances best known to G. G. on the spot.

London, England. W. H. BOOTH.

That "Born Mechanic."

Editor American Machinist:

I have read with interest several letters in your paper on the above subject, and, with your permission, will add a word or two myself.

There can be no question but that there are, as Victim intimates, born mechanics who might better have remained unborn; but why condemn broadly a natural gift simply because it has been abused by its owner? What is true of the born mechanic is also true of all geniuses, namely, that the possession of native talent is invariably accompanied by a corresponding danger to the owner. This is because poor human nature is so easily upset, and the joy at discovering that we are the possessors of some special gift or talent is so intoxicating that many cannot stand it, and their heads are straightway more or less completely turned.

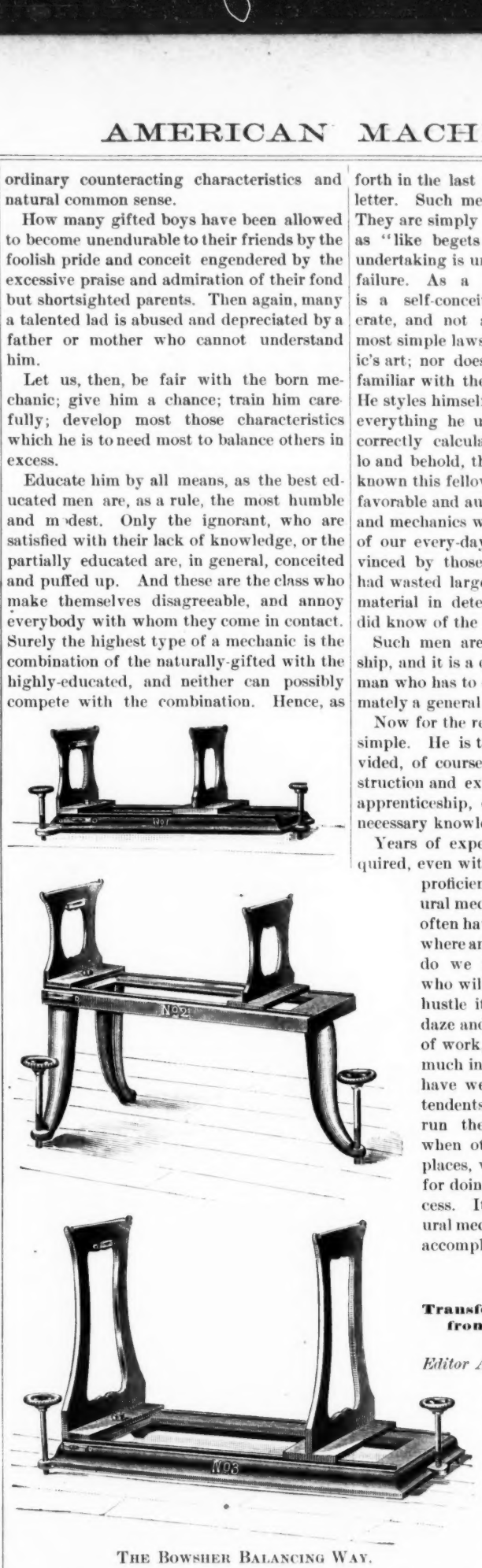
The same principle is exemplified in the acquisition of unearned wealth, which may prove a boon or a curse, according as its new owner has or has not sufficient good sense to use it properly.

I have the greatest sympathy for the born genius, for he has a power within himself which can either mar or make, the final result depending upon a great many different circumstances, not always within his own control. Left to himself, and not properly developed or trained, he usually becomes a complete failure, unless possessed of extraordinary counteracting characteristics and natural common sense.

How many gifted boys have been allowed to become unendurable to their friends by the foolish pride and conceit engendered by the excessive praise and admiration of their fond but shortsighted parents. Then again, many a talented lad is abused and depreciated by a father or mother who cannot understand him.

Let us, then, be fair with the born mechanic; give him a chance; train him carefully; develop most those characteristics which he is to need most to balance others in excess.

Educate him by all means, as the best educated men are, as a rule, the most humble and modest. Only the ignorant, who are satisfied with their lack of knowledge, or the partially educated are, in general, conceited and puffed up. And these are the class who make themselves disagreeable, and annoy everybody with whom they come in contact. Surely the highest type of a mechanic is the combination of the naturally-gifted with the highly-educated, and neither can possibly compete with the combination. Hence, as



THE BOWSHER BALANCING WAY.

native talent is a gift, and cannot be acquired, the born mechanic gains at the outset a start over all ordinary mechanics, which only needs to be appreciated and properly used to insure his rapid and lasting success. Let him, however, depend too much upon his genius, and he is sure to be outstripped, sooner or later, by his less gifted, but more persevering, companions. Nature treats well those who treat her well. No success is guaranteed, but if ordinary precautions and common sense prevail, the result cannot prove otherwise than satisfactory.

HENRY S. PRENTISS.

Born Mechanics.

Editor American Machinist:

I was amused with "A Victim's" description of the "Born Mechanic"; also, in "A Born Mechanic's" reply to "Victim." Both claim to be equally right in their opinions, and both advance strong points in behalf of their respective positions. But neither sifts the matter down as fine as might be.

However, I cannot help sympathizing with "A Victim," for the writer has also been slaughtered by a species of the long-eared persuasion, whose title is justly set forth in the last paragraph of "A Victim's" letter. Such men are not born mechanics. They are simply a mechanical abortion, and as "like begets alike," usually their every undertaking is unmechanical, which ends in failure. As a general rule, this fellow is a self-conceited genius, wholly illiterate, and not at all posted in even the most simple laws which govern the mechanic's art; nor does he wish to make himself familiar with the art of his chosen calling. He styles himself a born mechanic. Hence, everything he undertakes is just right and correctly calculated—until too late, when, lo and behold, the thing won't work! Have known this fellow to argue against the most favorable and authentic laws of philosophy and mechanics which govern the principles of our every-day work; would not be convinced by those who know better until he had wasted large amounts of both time and material in determining how little he really did know of the matter.

Such men are frequently met in partnership, and it is a deplorable condition for the man who has to contend with them; for ultimately a general crash is inevitable.

Now for the real born mechanic, pure and simple. He is the most valued of all—provided, of course, that he has the proper instruction and experience, either through an apprenticeship, or otherwise acquiring the necessary knowledge of his trade.

Years of experience and practice are required, even with natural talent, to become proficient. But he who is the natural mechanic gets there first. How often have we seen one party succeed where another has failed. How often do we find in the shop one man who will grapple a difficult job and hustle it through, while others will daze and dream over the same kind of work, and not accomplish half as much in twice the time. How often have we seen foremen and superintendents make failures, and almost run their shop completely down, when others would step into their places, with the same facilities only for doing business, and make a success. It must certainly be the natural mechanic who takes the lead and accomplishes the most.

MACHINAL.

Transferring Passengers to and from Moving Trains—The Born Mechanic.

Editor American Machinist:

Not long since Professor Sweet detailed a scheme for transferring passengers to and from rapidly moving suburban trains. I enclose a clipping which shows that a literary mechanic described the same thing some years since in a sort of "looking forward" style of prophecy. That the scheme is entirely feasible there seems to be no doubt. The track and apparatus would simply have to be designed for this special service. Still, if an unknown man had proposed the idea, few would have given it more than a passing smile.

I am of the opinion that the experience of "Victim" was not with one of the *genus homo* "born mechanics," but rather with a specimen of conceited bumptiousness, who bore as little resemblance to a real born mechanic as does a perpetual motion crank to an inventor like Edison. The born mechanic always turns a nut the right way; he saws a board off square, and don't break every tool he gets hold of. If he had not been a machinist he would have made a good carpenter or blacksmith. I know a man who can make a nice pattern or the entire woodwork of a carriage or sleigh; he can iron and paint a carriage in a superior manner; he can paint a fine portrait, and understands mechanical drawing; he can operate all ordinary styles of wood and iron-working machinery, and would pass as a good journeyman workman at several trades, although he never served a full apprenticeship at any, and only a year or two at carriage making. He was simply born that way. He could always see through things at once. He is not looking for a situation.

Since writing the above, another paper has come to hand and "Fay," taking his cue from "Victim," holds up another specimen of harmless conceit as a genuine born mechanic. I do not see why these fellows should represent a class of men whose mechanical training only supplements their natural inclinations, and the latter only should be called born mechanics.

I believe that most boys have qualities that will more readily develop into some particular line of business or occupation than any other, and that some boys have inherent qualities that may not be suppressed, but which will assert themselves to such an extent that they will become artists, musicians, mechanics or criminals, in spite of themselves, or the efforts of their friends. There are too many men that are not "made that way," and are being used as plugs to fit square holes.

I know an excellent business man who was a very poor locomotive engineer, and he had sense enough to concur in that opinion, as officially expressed to him by the master mechanic at the time of his discharge. He was a born merchant—a round plug in a square hole. The born mechanic is the man that always does everything he attempts in a workmanlike manner; it comes natural to him to do things right. He will never twist off a half-inch set-screw with a 2-foot wrench, nor blow out the gas. May his tribe increase.

PETER H. BULLOCK.

The Bowsher Balancing Way.

We give illustrations on this page of a new tool for machine shop use, intended to supersede the devices at present used for accomplishing the same purpose, and which are usually more or less makeshift in character.

This is intended to supply ways for balancing cylindrical work, such as cutter heads, pulleys, armatures, etc. It consists essentially of a bed, the upper surface of which is planed true, and has mounted upon it two standards, one of which is fixed in its position, while the other is movable to suit work of varying length, the same as the foot-stock of a lathe. The tops of these standards are planed off true, and upon the edges thus formed the shaft or arbor rests. The bed stands upon three legs, two of which are provided with adjusting screws as shown, so that the bed may be readily leveled up, and will stand steady after being leveled. Attached to the bed and to one of the standards are levels, which, being always in place and correctly adjusted, afford facilities for getting the edges readily in proper position, and the movable standard can be moved to suit work of varying lengths without disturbing the level position. In shops where any considerable amount of balancing is to be done, we should think this tool would prove very useful, and would save considerable time. It is made in three sizes as shown, the smaller being intended to set on the bench, and having a length of bed of 24", and a height of standards of 9½". The other sizes are intended to stand on the floor, the beds being 32" and 42" long respectively, and the heights of standards 12½" and 24½". They are made by N. P. Bowsher, South Bend, Ind.

The Imperial Statistical Bureau of Prussia has just published statistics regarding the number of steam boilers and engines in use in Prussia during 1890. The following are the figures, those given in brackets referring to the numbers employed in the previous year: Stationary boilers, 48,538 (47,151); stationary steam engines, 46,554 (45,192); portable boilers and locomotives, 12,822 (12,177); marine boilers, 2,046 (1,836); marine engines, 2,007 (1,674). In percentages the increases are respectively:—2.9 per cent., 3 per cent., 5.3 per cent., 11.4 per cent., and 19.9 per cent. The figures do not include those boilers and engines used in the Royal Navy or by the military administration.

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Where Room is Needed.

In connection with the patent centennial celebration at Washington an effort will probably be made to set influences at work which will result in giving to the Patent Office what it has long needed, *i. e.*, sufficient room in which to transact its business properly. Not long since it was seriously proposed to destroy a lot of the older copies of patents on file in the office, for the simple reason that the room to store them could no longer be afforded in the building. As is well known, the Interior Department, which gained entrance to the building some years ago, has steadily encroached upon the room which properly belongs to the Patent Office, until now the business which the inventors and manufacturers of the country pay for having done, and done properly, cannot be done properly.

The Patent Office is not a burden upon the government, but on the contrary is more than self supporting, the balance to the credit of the patent fund on January 1, '91, having been nearly four millions of dollars. This money has simply been taken from the inventors of the country by charging that much above the cost of what the government does for them, and as very important industrial and commercial enterprises are frequently delayed and embarrassed by the failure of the Patent Office to act promptly, it seems as though justice was not being done in this matter. It is an easy matter to get from an alleged "statesman" a spread-eagle speech telling what great things have been done for the country by its inventors, mechanics, engineers and manufacturers, especially if the statesman happens to need at the time some votes from such men; but when it comes to doing something practical in their interest, that is a different matter. This was clearly shown when there were efforts some time ago to get Congress to authorize and pay the expense of making a number of tests of structural materials on the Emery testing machine. The measure was defeated, simply because "there was no politics in it." Yet those tests would have been of the greatest value to engineers and mechanics everywhere, and through them to all others.

The Unemployed.

The spectacle of able bodied men wanting the common necessaries of life, and willing to work for them, yet unable to find employment, is quite generally recognized as an unnatural one, and is variously treated by those who feel called upon to discuss such matters. Some of those who fail to find a satisfactory explanation of the phenomenon simply deny its existence, and insist upon it that any one who is really anxious to work can, at any time, readily find work to do. Others acknowledge that men who want work are sometimes unable to find it, but contend that this is necessary for various reasons, some of which are very curious. Mr. Edward Atkinson is one of those who seem to think that opportunities for work are not really lacking, and that the stories told about the large number of men out of employment are without substantial foundation. As proof of this he relates how a sudden snow-storm in Boston brought a demand for men to clear the street railway lines, and advertisements in the city papers brought something less than three thousand men for the work. This is evidently regarded by him as clear evidence that not three thousand men had been unavoidably out of work in Boston at that time, a conclusion which seems to be unwarranted, because it is altogether probable that large numbers of men found employment of some kind by reason of the storm, of whom no account was taken, and only the most able-bodied would be fit for the work in the streets. It is a matter of common observation that there are times when large numbers of men want work and cannot find it, and so far as we can see, Mr. Atkinson's instance does nothing towards disproving it. Its citation, however, is not discreditable to him, and in this respect it differs from the position of the editor of the *Evening Post*, of this city, who, commenting upon the action of a conference held in England, regarding the labor troubles, and the problem presented by the fact that there were in east London alone 30,000 men unable to find work, the greater part of these being responsible citizens, and heads of families, called it "a conference about nothing," and actually advanced the idea that a certainty of being able to find something to do by which to earn a living would cause the men now in employment to "grow more and more careless and insubordinate in doing such work as they already had," and that "probably 500,000 men are kept 'up to the mark' in London by the sight of these 30,000 industrial failures." A more brutal treatment of this subject would be hard to find, we think. It is evidently founded upon the assumption that human nature, as found in those who work with their hands, is different from that found in other classes, such as editors, and that those who work with their hands have no interest whatever in their work, and are not faithful in it because of such an interest, or by reason of a desire to give a fair return for wages received, nor on account of any ambition to rise to higher positions in their lines of work, and in short that they are not actuated by any of the motives which affect men's conduct in other pursuits, but do their work just well enough to prevent unemployed men from getting their places.

We have always said, as we say now, that the best skilled men, men who take pains to stand in the front rank in their occupation, will usually find plenty of demand for their services, at good wages, but excellence is worth striving for, and in fact, we believe it is usually attained from motives entirely outside of this fact. But the fact that the best men will always find work, does not prove that those who are not the best deserve no opportunity to earn an honest living by work, and to say that their suffering and that of their families is necessary in order to keep the best men "up to the mark" is nothing else than an evidence of ignorant brutality.

Fireproof Buildings.

It will be in order soon—indeed, why is it not in order now?—to pass a law forbidding the erection of tall buildings that are not absolutely fireproof.—*N. Y. Tribune.*

A building that shall be entirely fireproof is just what men have been trying to construct for a good many years. It is probably practicable to construct buildings in all particulars, inside and outside, of material that will not burn at any ordinary temperature, but that does not prevent the destruction of the building by fire. In many instances such buildings would not withstand the heat of their burning contents. And as was shown pretty conclusively a few years ago, both at Chicago and Boston, heat from adjacent burning buildings usually tests their fireproof qualities beyond endurance. Iron or steel will twist and bend out of shape when subjected to high temperature, and granite has proved itself a poor material to resist heat.

No doubt buildings could be made more nearly fireproof than those so-called are usually made, but it is probably not practicable to make them entirely fireproof until all surrounding buildings—high or low—are similarly constructed. In the instance to which the *Tribune* refers—the nine-story building recently burned at Bleecker and Greene streets, this city—there appears to have been no serious attempt at making it fireproof, except in making the outer walls of iron, and it is said the city authorities were warned to that effect by the chief of the fire department when the building was being erected.

The Tunnel Bill.

The bill introduced at Albany by Assemblyman Sulzer, aimed at the Fourth Avenue tunnel, in New York, is perhaps as well as anything in its way about as it stands. It provides that in cities in the State of New York "having a population of over one million inhabitants, all tunnels used by steam railroads shall be ventilated by such mechanical or other devices or appliances as shall keep them clear of smoke, steam," etc. An impossibility, of course, but then any court would undoubtedly construe reasonably clear as being "clear." No one, not even the railroad company, is likely to take exception to this.

Then it is further provided as follows:

Such tunnels shall also be lighted and kept sufficiently lighted by electric or other lights, to prevent the collisions of trains or other accidents in said tunnels, and to enable locomotive engineers or other employes of said steam railroads, operating trains in said tunnels, to see any obstructions on the tracks.

As this calls for no special means of lighting, it would appear that it could do no particular harm if enacted.

There is quite a difference in opinion amongst railroad engineers as to the advisability of using electric lights in the tunnel, although there appears to be little or none amongst experts who know nothing about locomotive engine running. The only thing to hope for is, that the ventilating and lighting shall be to the end of the greatest safety, which, we have no doubt, is what the railroad company wants.

In a recent trial, in which the defendant was charged with setting fire to a building, one of the witnesses, who was a chemist, testified that burning alcohol would flow across a wooden doorsill without charring the wood. The district attorney, however, was equal to the occasion. He caused the experiment to be tried in court, with a decidedly different result. This was an instance in which theory didn't count.

Years ago, competition in the way of swift ocean passages was between sailing vessels instead of between steamships. Then it was that the "Yankee" clippers beat the world. And the recent passage of the clipper "Saint Paul" from Queenstown to New York, in sixteen days, shows that the making and handling of sailing vessels is not amongst the lost arts.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(146) S. T. W., ——, writes: Please give rules for gears for screw cutting. *A.*—Will be found in issue of March 12, Question 121.

(147) C. H. R., ——, asks: What composes the mixture generally used on finished steel to give it a copper color, that a design may be marked thereon? *A.*—Dissolve bluestone in water, and apply it to the steel; or, take a piece of the bluestone (which can be obtained at any drug store), wet it in water, and rub it over the steel.

(148) F. K., Stapleton, N. Y., asks: Will a person be allowed to run a 5 horse-power engine and boiler without a license? And at what age can a person obtain a license? *A.*—The laws relating to licenses vary in different localities; in fact, in many places, licenses are not required for running any size of engine and boiler. We advise you to apply to the police department of the place in which you reside.

(149) Amateur Mechanic, ——, asks: Can a person by studying thoroughly Geo. B. Grant's gear book understand the theory of, and how to cut practically perfect gears? *A.*—If you thoroughly understand all this book contains, you will be able to lay out gears for any practical purpose. 2. Please give name of another work on gears that an ordinary mechanic can understand, and which is not composed entirely of mathematics. *A.*—Practical Treatise on Gearing, by Brown & Sharpe Manufacturing Co., Providence, R. I. Your other question is out of our line.

(150) C. D. B., Portland, Ind., writes: Please refer me to books recently published which will give me information relating to tempering steel. Also books treating on

brazing and soldering. *A.*—Practical Blacksmithing, Vol. III, by M. T. Richardson, New York, contains articles on tempering steel. Mechanics' Own Book, published by E. & F. N. Spon, New York, gives hints on brazing and soldering. Condensed Suggestions for Steel Workers, by Miller, Metcalf & Parkin, Pittsburgh, Pa., contains much valuable information. But the best way to acquire a knowledge on these subjects is by experience in the shop, and intelligent application.

(151) O. M. B., Fincastle, Va., writes: Please inform us whether we can test boilers with a hand force pump, and if so what size of pipe should be used? *A.*—You can test boilers by a hand force pump; in fact, many are tested in that way. The inside diameter of the pipe should not be less than the diameter of the opening for the discharge in the pump; a little larger is not objectionable. 2. What should the testing pressure, so that it will be safe to set the safety valve at 100 pounds? *A.*—The test pressure should not be greater than one and one-half times the working pressure; some boiler makers do not allow the former to be greater than one and one-quarter times the latter. Hence for a working pressure of 100 pounds the test pressure should be from 125 to 150 pounds.

(152) C. H. B., Taunton, Mass., writes: Kindly answer the following questions: 1. What is meant by the terms "line-shaft cones" and "countershaft cones"? *A.*—A line-shaft is the main, or one of the main shafts in a room, from which other shafts or machines receive their motions, and cones put on this shaft are called line-shaft cones. A countershaft is a smaller one transmitting the motion from the line-shaft to a machine, and a cone on this shaft is called the countershaft cone. 2. How could I obtain the size of the steam fixtures for a printing press, if the speed is given? *A.*—Write to the maker of the printing press, who can give you the power required to drive it; from this the details may be worked out. 3. Where can I obtain a book treating on the construction and manufacture of printing machinery? *A.*—Write to any dealer in scientific books for a catalogue, and make such selections as may be suitable for your purpose.

(153) J. P. M., Baltimore, Md., writes: Please explain how two cable street railway lines can cross one another in regard to cables. *A.*—The cables do not cross each other; the cars cross the tracks by their stored up energy or other motive power. 2. Please inform me of a simple method of making blue prints, one that could be used conveniently at home. *A.*—See answer to Question 117 in our issue of March 5, current volume. 3. What is the stroke of an engine of which the distance from the center of the main shaft to the center of the crosshead pin is 104 inches when the crosshead is furthest from the shaft. The rod is seven times as long as the crank. Please give rule for computing the stroke. *A.*—Under the conditions given, the crank points towards the crosshead when the latter is 104 inches from the center of shaft, and since the rod is 7 times as long as the crank, it follows the length of the rod must be $\frac{7}{8}$ of 104 inches, and the length of crank $\frac{1}{8}$ of 104 inches. Now $\frac{1}{8}$ of 104 inches is 13 inches, and the stroke must be equal to twice the length of the crank; hence $13 \times 2 = 26$ inches is the stroke of the engine.

(154) W. F., ———, writes: Please answer the following questions: 1. Can 1,872 cubic feet of steam at atmospheric pressure be raised from one cubic foot of water? *A.*—Authorities differ in regard to the relative volumes of steam and water. We believe your figure is too high. According to the tables generally accepted, the relative volumes at atmospheric pressure are as 1 to 1,644; hence, 1 cubic foot of water will give 1,644 cubic feet of steam at atmospheric pressure. 2. How many cubic feet of steam at 80 pounds pressure can be raised from 1 cubic foot of water? *A.*—At 80 pounds absolute pressure (that is, the boiler pressure plus 14.7 pounds), 328.3 cubic feet of steam will be obtained. 3. What would be the horse-power of a boiler 5 feet diameter, 18 feet long, with twenty 6-inch flues and ten 4-inch flues? *A.*—We should rate it at 64 horse-power. 4. Will 20.25 square feet of grate surface be sufficient for such a boiler? *A.*—We prefer 25 square feet for soft coal; for hard coal the grate surface should be still larger. 5. What vent will be required to distribute the heat equally through the tubes? *A.*—We do not quite understand your question. If you mean the area of the opening above the bridge wall, make it $\frac{1}{3}$ of the grate surface.

(155) W. J. S., McComb City, Miss., writes: Please inform me how to lay a curve for a railroad crossing when the radius of the curve is given, but the radius being too large for drawing the curve in the shop. I wish to cut the curve or arc on a board, say 15 to 20 feet long, which I may use as a template. The radius is 214 feet. *A.*—If we understand you correctly, the problem is simply to describe an arc of a circle which is too large for drawing it with beam compasses. The first step will be to compute the height $f\ d$ (Fig. 1) of the arc for a given length of template; let $a\ b$ be this length equal to 20 feet, and $d\ e$ the diameter drawn perpendicular to $a\ b$, then $f\ b$ will be 10 feet, and $c\ b$, the radius, 214 feet. Here then we have a right-angled triangle $b\ c\ f$, whose hypothenuse $c\ b$, and side $f\ b$ are known, and consequently we can easily find the side $f\ c$ by subtracting the square of $f\ b$ from the square of $c\ b$, and extracting the square root from the remainder. Thus $(214 \times 214) - (10 \times 10) = 45,696$, and the square root of 45,696 is 213.76, which is the length in feet of the side $c\ f$; subtracting this from the radius, we have $214 - 213.76 = .24$ of a foot, or very nearly 3 inches for $f\ d$. Fig. 2, lay off the chord $a\ b = 20$ feet, and the height of the arc $d\ f = 3$ inches. Join a and d, also d and b, by straight lines, and from d as a center, with a radius $d\ f$, describe a circle cutting the line $d\ b$ in the point g; make the arc $g\ h$ equal to the arc $f\ g$, and join d and h by a straight line. Divide this line into any number of equal parts, and thus obtain the points of division 1, 2, 3; from these points draw straight lines to b. Divide $d\ f$ into the same number of equal parts as $d\ h$, thereby obtaining the points of division 4, 5 and 6. Through a and 4 draw a straight line, and prolong it to meet b 1 in i; this point will be

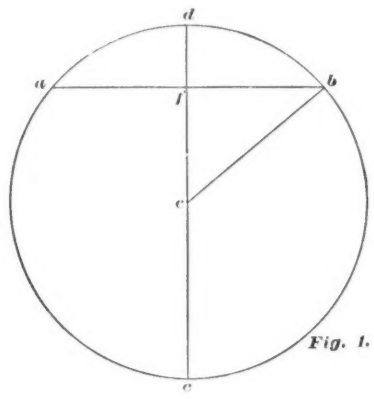

Fig. 1.

one point in the arc. Through a and 5 draw a straight line, and prolong it to meet b 2 in k; also through a and 6 draw a straight line to meet b 3 in l; then draw a curve through the points d, i, k, l and b, which will be one-half of the required arc. The other half is drawn in a similar way. Points in the arc may also be found, as shown in Fig. 3. Draw the chord $a\ b$, and the height $d\ f$ of the arc; join $a\ b$ by a straight line, and through d draw a line parallel to $a\ b$. Now cut out a board $p\ d\ m\ n$, whose upper edges coincide with the lines $a\ d$ and $d\ m$. Move the board so that its edge $p\ d$ will touch the point a, and the edge $d\ m$ will touch the end d of the line $d\ f$; the point d on board will lie in the arc, which may be pricked off. In a similar way, any number of points in the arc may be found, and joining these points will give the required arc.

(156) A. A. L., Johnstown, Pa., writes: Is not your answer to Question 91, current volume, slightly misleading to a beginner? The answer is well stated for an easy remembrance, the answer being, horse-power $= \frac{P\ L\ A\ N}{33,000}$, L representing the length of the stroke as stated by you, but you fail to state whether in feet or inches. Now as it would seem as though none but a beginner would ask this question, he might be led very much astray in applying the value of L, and I think you will agree with me that L represents the length of stroke in feet, and that the formula would read $\frac{2\ L\ (P\ A\ N)}{33,000}$, or $\frac{2\ L\ (N\ A\ P)}{33,000}$. If your questioner will not think his memory too much taxed, it would be the piston speed in feet per minute by mean effective pressure, by area of piston. The above is written in good faith, knowing you are perfectly able to solve such a simple problem. At the same time, the statement $\frac{P \times L \times A \times N}{33,000}$, although easy to remember, does not strike the writer as being as correct as something expressed in more words. The above is written solely for the benefit of your questioner, and not for notoriety, and as I have seen the same answer given before in your columns, I thought it might prove a stumbling-block to the unwary. *A.*—We agree with our correspondent that L denotes the length of stroke in feet, and we did not intend it to be taken in inches, although we must acknowledge that omitting the words "*in feet*," may lead beginners astray, and we thank our correspondent for calling our attention to it. We always endeavor to avoid all ambiguity, but it will sometimes creep in without being noticed, just as it did in our correspondent's remarks, where he neglects to state the unit of the area of piston; of course it will be understood that he means to say, "the mean effective pressure *per square inch of piston* should be multiplied by the area *in square inches* of the piston"; beginners might take the area in square feet. Our correspondent is wrong in his statement that the formula should read $\frac{2\ L\ (P\ A\ N)}{33,000}$, because in our answer we have plainly stated that N denotes the number of strokes per minute; under these conditions his formula would give the horse-power twice as great as that of the engine. Of course if N denotes the number of revolutions per minute (but A. A. L. does not say so) then his formula will give correct results, because there are two strokes to each revolution of the crank-shaft. But when N denotes the number of strokes per minute, as we have said it did, then horse-power $= \frac{P \times L \times A \times N}{33,000}$ is correct, and we fail to see why it is not as correct as something expressed in more words. Indeed, formulas possess a great advantage over rules expressed in the ordinary language, because the latter do not show at a glance the whole mode of procedure, as a formula does indicate, and therefore it taxes the memory to a less degree; besides this, we believe that, with the use of a formula, mistakes are not as liable to occur as when a solution is to be worked out by a rule. We have only to substitute for the symbols in the formula their given values, and then work out the solution as indicated by the signs.

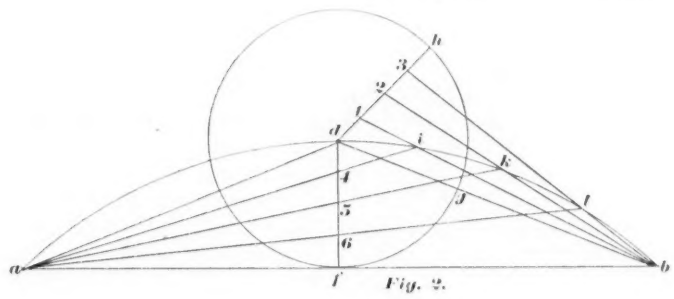

Fig. 2.

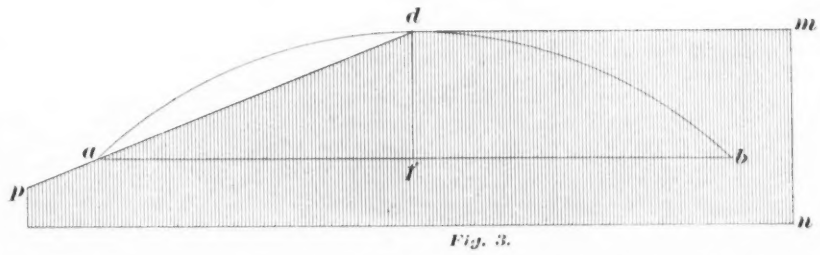

Fig. 3.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gears, gears, gears, gears, gears. See page 20.

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Over 50,000,000 feet of Link-Belt in use.
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Universal and plain Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

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Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

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For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

"Twenty Years With the Indicator," by Thos. Pray, Jr., 9,500 sold. Price $2.50. Order of bookseller, take no other.

Audubon Machine Works, New Haven, Conn. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

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For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n

For the latest Improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

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Reed's Engineer's Hand-book, 13th edition, 600 pp. 324 diagrams, 36 large plates, postpaid $4 50. Theo. Audel & Co., 91 Liberty st., N. Y. Catalogue free.

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De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

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"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

Work has commenced on the ice factory at Beeville, Tex.

A $150,000 cotton-mill is reported as to be erected at Hillsboro, N. C.

J. C. Shaw, of Collins, Ohio, will remove his pump works to Clarksville, Tenn.

It is reported that J. H. Krause will start a brass and iron foundry at Tampa, Fla.

C. M. Cross, of Berlin, N. H., is building a foundry in connection with his machine shop.

The city of Austell, Ga., will let contract for the establishment of an electric light plant.

The Virginia Steel and Iron Company has been formed at Richmond, Va.; capital, $2,000,000.

The National Machine Company has been incorporated, at Hartford, Conn.; capital, $30,000.

The Vance Cotton-mills will be the name of the new mill which is projected at Salisbury, N. C.

The Lead Hill Foundry and Machine Shops, at Lead Hill, Ark., expect to put in new machinery.

W. C. Codd, of Baltimore, Md., is negotiating for the establishment of boiler works in Roanoke, Va.

The erection of a cotton-mill at Tullahoma, Tenn., is proposed. G. R. Crane can give information.

Efforts are being made to secure a branch factory in Sulphur Springs, Tex., of the Baker Wire Company.

It is reported that the Progress Manufacturing Co., at Meridian, Miss., will enlarge its machine works.

The Lakeland (Fla.) Electric Light Company will, it is stated, establish an electric light plant at a cost of $6,000.

There is talk of the erection of another cotton-mill at Reidsville, N. C. W. C. Staples can give information.

The Texas Roller Compress Company has been incorporated at Galveston, Tex., with a capital stock of $500,000.

George Baring and Oscar White are erecting and will operate an iron foundry and nail factory at St. John, N. B.

An ice factory, to cost about $10,000, will be built at Colorado, Texas. G. H. Colvin and others are interested.

The Paige Tube Company, of Warren, Ohio, will erect a foundry 50x75, for the purpose of doing their own casting.

It is reported that the cotton-mill of the Anniston (Ala.) Manufacturing Company is to be considerably enlarged.

An iron foundry and machine shops are to be establishedat Lampasas, Texas, by Kansas and Missouri parties.

A Marion (Ohio) party has made a proposition to establish an iron foundry and machine shop in Winchester, Tenn.

Catesby Jones and others are reported as organizing a stock company to erect an iron furnace at Iron Gate, Va.

The Hall Machine Company are to erect large shops at Deering, Maine, capable of employing from 300 to 400 men.

The Russellville (Ark.) foundry and machine shop will be enlarged. J. M. Luken has bought an interest in the mill.

The Knoxville, Cumberland Gap & Louisville Railroad Company will establish repair shops at Knoxville, Tenn.

The Newport News & Mississippi Valley Railroad Company is reported as to establish machine shops at Lexington, Ky.

Mr. Patterson is reported as having started a factory for the manufacture of a patent plumb level, at St. Elmo, Tenn.

H. V. Meigs, of Macon, Ga., is reported to be interested in a project to establish a cotton-mill at San Antonio, Tex.

New York and Philadelphia (Pa.) capitalists will, it is stated, establish a $100,000 pipe works at New Birmingham, Tex.

Philpott & Leuppie have broken ground at Niagara Falls, N. Y., for a machine shop 80x38 feet, two stories in height.

The Campbell & Zell Co., at Baltimore, Md., will increase their capital stock to $150,000 and enlarge their boiler works.

The Southern rolling-mill at Avondale, Ala., is to increase its capacity by the addition of ten more puddling furnaces.

A cotton-mill with 6,000 spindles will be built immediately at Honesdale, Pa. W. W. Wood, Box 715, can give information.

The Old Dominion Iron and Nail Works Company, Richmond, Va., contemplate the enlargement of their plant at an early date.

J. C. Mallison, of Brenham, Tex., is investigating, with a view of establishing an agricultural implement factory in Austin, Tex.

Negotiations are pending at Pulaski City, W. Va., for the erection of boiler and horseshoe works. W. H. Calfee & Co. are interested.

It is stated that the Atlanta Machine Works, of Atlanta, Ga., will put the Opelika (Ala.) Ice Company's ice factory in operation.

The Cincinnati South rn Railroad Co. (office, Cincinnati, Ohio,) is reported as to move its Somerset machine shops to Burgin, Ky.

The Ragsdale Manufacturing Company, Greenwood, Miss., expects to put an electric light plant in its foundry and machine shop.

The Hazen Company, of Anderson, Ind., is now erecting an immense nail plant, and contemplate the erection of a steel billet plant.

The Brook Axe and Edge Tool Works, at Brooksville, Vt., will be reopened in the spring by a new company, having a capital of $50,000.

An Ohio iron manufacturing company is reported as having made a proposition to erect an iron furnace and rolling-mill in Trenton, Ga.

Adams & Marriott, of Kansas City, Kans., have made a proposition to remove their $200,000 rolling-mill at Rosedale, Kans., to Austin, Tex.

The Florence (S. C.) Improvement and Manufacturing Company has, it is reported, made arrangements for the erection of an ice factory.

The Cincinnati Southern Railroad Company, it is stated, contemplate the removal of their machine shops from Somerset, Ky., to Burgin, Ky.

The Board of Trade has accepted the Omaha, Kansas City & Galveston Railway Co.'s proposition to establish machine shops, at Denison, Tex.

J. H. Ferguson, of Bridgeton, N. J., is reported as having signed a contract for the removal of his boiler and machine works to Basic City, Va.

A rolling-mill and cotton tie factory are reported as to be erected at Sylacauga, Ala. The Marble City Land and Furnace C mpany is interested.

The Ohio River Railroad Company (office, Parkersburg,) is reported as to erect machine shops and roundhouses at the projected town of Central City, W. Va.

The West Virginia Central & Pittsburgh Railway Company (office, Baltimore, Md.,) will add, it is stated, car shops to its machine works at Elkins, W. Va.

The estimated cost of the machine shops which the Norfolk & Western Railroad Company contemplate establishing at Shenandoah, Va., is about $60,000.

The Case Engine Company, of New Britain, Conn., are building an addition, 35x50 feet, to their shops, and will soon have it equipped and ready for occupancy.

It is stated that Canadian parties are in negotiation with the Chattahoochee Land Company, looking to the establishment of tool works in or near Atlanta, Ga.

The Martin's Ferry Boiler Company, of Martin's Ferry, Ohio, has, it is stated, contracted with the city for the removal of its boiler works to Cameron, W. Va.

The James Reynolds Machine Company has been organized at New Haven, Conn., to manufacture, buy and sell general and special machinery, and machine tools.

R. J. May has sold his foundry and machine shop, at McKeesport, Pa., and has purchased another site, on which he will erect a much larger plant, to cost about $50,000.

The Albion Iron Works, capital $200,000, has been organized at Knoxville, Tenn., to build a foundry and machine shop. A. L. McEwon, manager, Cincinnati, can give information.

W. G. Upchurch is president, J. J. Thomas vice-president, and F. O. Moring secretary of the Caraleigh Mills Company, which contemplates erecting a cotton factory at Raleigh, N. C.

The Southover Land & Improvement Company will, it is reported, issue $200,000 of stock for the purpose of building a cotton-mill at Savannah, Ga. The mill will be located at Southover Junction.

J. J. Thomas is president, B. F. Dancy vice-president, and F. O. Moring secretary of the Caraleigh Phosphate and Fertilizer Company, recently organized to erect a fertizer factory at Raleigh, N. C.

A Pennsylvania party has been investigating for a site for a road machine factory, around Charlestown, W. Va. The Charlestown Mining, Manufacturing and Improvement Company can give information.

The Danville & East Tennessee Railroad Company contemplates the erection of repair shops at Damascus, Va. T. W. M. Draper, vice-president and general manager, Norfolk, can give information.

It is stated that the $130,000 which has been raised at Holly Springs, Miss., by subscription, and which was to have been used as an inducement for the location of a college, will now be invested in a cotton-mill.

The American Iron Works Co. (Berryville, Va.,) has commenced work on its boiler and engine works, consisting of two buildings 86x80 feet, and two 80x200 feet. When completed 300 hands will be employed.

It is stated that the Lockhart Shoal Cotton Factory, to be established at Union, S. C., is an assured fact, and that work has been begun on the foundation, and the building will be pushed rapidly to completion.

The Curry Signal Company, Danville, Ky., has been incorporated by G. W. Welsh, A. M. King and T. P. Curry, with a capital stock of $100,000. Its purpose is to make, lease and operate the Curry automatic railway signal.

The Dixon Manufacturing Company, recently incorporated, has for its purpose the manufacture of cotton and woolen goods, and establishment of iron foundry and machine shops, at Snow Camp, N. C. H. W. Dixon is president.

The Western Rolling Stock Company, of Chicago, has been incorporated, with a capital stock of $100,000, by George E. Farley, Grant S. Wheeler, and William E. W. Johnson. It will manufacture cars, engines and other rolling stock.

The Golden Foundry and Machine Company, Columbus, Ga., has completed its iron foundry and machine shops. The iron foundry is 25x80 feet, the blacksmith shop 60x40 feet, and the machine shop is L-shape, 100x60 feet and 150x40 feet.

The Chickasaw Iron Works, Memphis, Tenn., manufacturers of architectural iron work, cotton presses, engines, boilers, saw-mills, shafting and machinery supplies, etc., have obtained a charter of incorporation, under the above name.

The Danville Foundry and Machine Company, of Danville, Ill., has been incorporated, to do a general foundry and machine manufacturing business; capital stock, $75,000. The incorporators are William Stewart, Mary Stewart and L. A. Chesley.

The Homer Machine Company, with $25,000 capital, has commenced business in the Whitcomb building, on Front street, Holyoke, Mass. New machinery is being put in. Fifteen hands are employed, but this number will soon be doubled.

The Britton Rolling-mill Company has been recently formed at Cleveland, Ohio. It will have a plant equipped with entirely new machinery, for the purpose of making steel of a fine quality. Special attention will be given to soft steel sheets.

The New Monitor Company, with a capital stock of $50,000, has been organized at Chicago, for the manufacture of agricultural implements, and to conduct a foundry and planing-mill; incorporators, E. Listenwalter, C. N. Coats and P. E. Simmons.

J. A. Adams, C. H. Arnold, J. T. Stocks and others have incorporated the Adams Sewing Machine Motor Company, of Atlanta, Ga., to manufacture sewing machines, and spring motors for operating the same. The capital stock is $160,000.

Swanton, Vt., has voted to exempt the Barney Marble Company from taxation for five years, on condition that the company spends during the coming year not less than $20,000 in improvements. The company contemplates building a new $50,000 mill.

The South Florida Foundry and Machine Co., at Orlando, Fla., has been reorganized as the South Florida Foundry and Machine Works; capital stock, $150,000. It is stated that the company will erect a new building, and put in $15,000 worth of new machinery.

The American Iron and Steel Company has been organized, with a capital of $1,500,000, to build works at Cle-Elum, Wash. Cle-Elum is on the Cascade division of the Northern Pacific, on the Yakima River. Coal and iron mines are in the immediate vicinity.

The Morris Machine Works, Baldwinsville, N. Y., have issued a new catalogue of centrifugal pumping machinery. They make a specialty of this machinery for a variety of purposes. The catalogue gives a good idea of what they manufacture, and the uses of different pumps.

Howard & Sears, who are the contractors for building the Craig Creek branch of the Chesapeake & Ohio Railroad, have secured a license for the Adams process for Craig County, Va., and will proceed to erect a steel works near New Castle, with a capacity of 100 tons a day

The Ansonia Brass and Copper Company, 19-21 Cliff street, New York, has issued a new edition of the catalogue on "Tobin Bronze." The catalogue gives some of the uses to which this bronze can be put, manner in which it can be worked, its strength, and many testimonials from those who have used it.

H. B. Cragin, agent of Washburn & Moen, the barbed wire manufacturers, of Massachusetts, announces officially that the company has purchased between 800 and 1,000 acres of land adjoining the town of Waukegan, a few miles north of Chicago, and will begin work on its manufacturing plant there this spring.

The Fort Worth & Denver Railroad Company are now working 175 men in their machine shops at Fort Worth, Tex., and will increase the force to 300 men as soon as the new shops are ready. The Texas & Pacific Company have 105 men employed in their machine shops located in the same city, and will shortly add to that number.

Contracts have been signed for the removal of the Shaw Electrical Crane Works, of Milwaukee, to Muskegon, Mich. A large foundry and workshops will be erected at once, and part of the works will be in operation by the 10th of August. The company will be reorganized under the laws of Michigan, and will employ from 400 to 500 hands.

The Ætna Iron Company, at Bridgeport, Ohio, will soon begin the erection of buildings to accommodate the additional machinery they will add to their plant. Just what improvement will be made is not known, but it is stated on good authority that when completed the Ætna will be one of the largest mills of the kind in America. The Standard will also increase its capacity considerably in the spring.

McVay, Walker & Co., founders, of Braddock, Pa., have commenced the erection of a new foundry at that place that will cover 450x90 feet of space, and give employment to 60 men. The present plant of this firm was the first manufacturing establishment built at Braddock, having been erected in 1866. The new foundry is intended to do much of the heavy work for the Edgar Thomson Steel Works of Carnegie Brothers & Co., Limited, at Braddock, Pa.

A note in our issue of March 19, in reference to the James River Steel and Iron Company, of Richmond, Va., gave the capital stock of the company as not to exceed $200,000, and the name of the treasurer as Mayer. The name of the treasurer and secretary is L. T. W. Marye, who writes us to say that the capital stock of the company is not *less* than $200,000 nor more than $1,000,000. He also says: "We own the famous Greenway system of ores, including Riverville and Stapleton mines, and intend to develop the same."

The Dixon Crucible Company, Jersey City, N. J., having made an exhaustive study of the subject, claim to be able to furnish plumbago for foundry facing exactly suited to the special requirements. They say: "One kind of plumbago is better applied by the shake-bag, and if the brush is used, another kind will prove better. One preparation of plumbago will 'sleek,' another will not. Another kind is more useful for light castings, another kind for heavier work." The company will give any advice required as to the use of pumbago, and on application will send a little book free and postpaid, which, to quote, "contains more information on the subject of plumbago than is elsewhere in print in any language."

Factory Inspection in New Jersey.

Factory Inspector Wenthal, in charge of the Hudson County district, in the annual report, amongst other things says:

"The employment of minors in factories is fast diminishing. During my first year in office, as my last report shows, a large number of children were employed under 14 years of age. I can safely say that it has decreased fifty per cent. this year. I find that a great many manufacturers do not want such help, and when we find them in the factories, as a rule, they misrepresent their ages. In some of the larger factories they get into the shops through some trick or device, and I might say a great many of them are taken into the workshops by their parents under a misrepresentation. On a recent inspection in Clark's O. N. T. factory at Kearney, I found twelve girls under 14 years of age. On questioning them I ascertained their right ages, and asked them how they managed to get employment in the factory. In many cases they told me that their parents told them to tell the superintendent that they were 15 years old. The most astounding revelation of the employment of child labor that ever came under my observation as inspector, was in the barrel department of the Standard Oil Works. I found fifteen boys, their ages ranging from 8 to 11, employed there, and most of them earning eighty-five cents per week."

Modern Physics.

So many people regard the atomic theory as a solid statement of fact, and the ether as existing "stuff," that engineers are now probably open to assimilate more scientific notions. Modern science declares that energy is much the same kind of thing as matter. Though it has no inertia, and is not acted on by gravity, it is indestructible and can always be localized like matter, and presumably occupies space as matter does, but independently of it. If energy disappears in one place it appears somewhere else, and in the meantime it moves from one place to the other. Professor Poynting, in his papers, which have formed the basis of some of these theories, carefully pointed out that he made use of assumptions; but that has been forgotten. Modern science also declares that action at a distance does not exist. The argument is that we cannot conceive it. Many people say they can conceive action at a distance quite as well as atomic lumps rattling together, but that is by the way. Modern science says, "What is inconceivable does not exist." As conceivability depends on experience, this is another way of stating that modern science has experience of the whole universe. Being told that a "pull" does not exist in nature, and Professor Poynting having shown how energy moves about, we gather from the teachings of modern science that when a portable engine drives a threshing machine, the energy goes from the engine to the thresher, through every part of the universe except the belt. The belt is the only thing made or created that does not help to drive the thresher. There are many other interesting cases of a similar kind, but perhaps one is enough to assimilate at a time.—*Industries.*

At three or four of the Scotch iron works, the Furnace Gases Company are paying a yearly rental for the right of collecting smoke and gases from the blast furnaces. These are passed through several miles of wrought-iron tubing, gradually diminishing in size from 6 feet to about 18 inches, and as the gases cool there is deposited a considerable yield of oil. At Messrs. Dixon's, in Glasgow, which is the smallest of these installations, they pump and collect about 60,000,000 feet of furnace gas per day, and recover, on an average, 25,000 gallons of furnace oils per week, using the residual gases, consisting chiefly of carbon monoxide, as fuel for distilling and other purposes, while a considerable yield of sulphate of ammonia is also obtained. In the same way a small percentage of the coke ovens are fitted with condensing gear, and

produce a considerable yield of oil, for which, however, there is but a very limited market, the chief use being for the Lucigen light, and other lamps of the same description, and also for pickling timber for railway sleepers, etc. The result is that four years ago the oil could be obtained in any quantity at ¼d. per gallon, though it has since been as high as 2½d. per gallon. It is now about 2d. per gallon and shows a falling tendency. Make a market for this product, and the supply will be practically unlimited, as every blast furnace and coke oven in the kingdom will put up plant for the recovery of the oil. As, with the limited plant now at work, it would be perfectly easy to obtain 4,000,000 or 5,000,000 gallons per annum, an extension of the recovery process would mean a supply sufficiently large to meet all demands.—*London Engineer.*

G. F. Badger, who has been for some years treasurer, secretary and general manager of the Pulsometer Steam Pump Co., of this city, has accepted a position with John Maslin & Sons, who are in a similar line of business. His office is 165–167 First street, Jersey City, N. J.

Accuracy that can be Practically Attained by Hand-work.

BY JARNO.

One of the principles upon which the accuracy of hand-work much depends is that, having made a test of the work, the cutting tool, held in the hand, can be applied to reduce only the high places, without touching the low ones. This can go on indefinitely, so that the work finally becomes as accurate as the test is capable of distinguishing.

The test of finding the high places by rubbing one piece upon another is one of the most delicate in the whole range of machine shop practice. In order to form an idea of the delicacy of this test, let us rub a cylindrical piece, one inch in diameter, upon a surface plate. Now, if in the cylindrical piece we rub off a flat place six one-thousandths inch wide, which is the width of lines on a common scale, we shall reduce the piece only one one-hundred-thousandth of an inch. Hence, with a perfect surface plate, this test for the straightness of a cylinder is far more delicate than any others that I have spoken of.

The perfection of surface plates is also an example of this test. We have not yet made a machine that will make plates as nearly perfect as they can be made by hand.

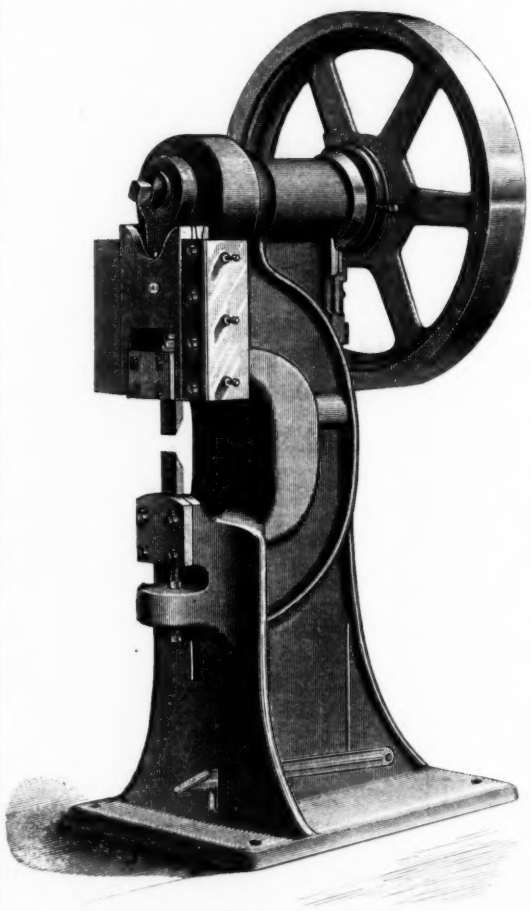
In every test we may be met by difficulty from the elasticity or springing of the pieces. To illustrate the elasticity of hardened steel, let us have it in the forms of a one-inch plug, and a closely-fitting ring. Now take another plug a ten-thousandth of an inch larger, and we shall find that it can be put into the ring, when well oiled, and that it may be moved easily, as if not fitted tight.

In these papers I have adhered closely to the practical, though in giving the limits I confess the practicality belongs to a high grade of skill, yet I think that every workman that reads the AMERICAN MACHINIST, if he does not already possess it, can acquire this skill. The workman that has assisted me in this subject has been engaged in his specialty for a matter of a dozen years. Nearly half the time in these years he has worked with a glass at his eye. He is something more than a mere workman—he is an artist. To file two templates so as to exclude light, as this man did, and as quick as he did, requires a touch as delicate and as true as that of a musician or of a painter. A minute's watching him will convince any one that he is eminent in his specialty. And now, in closing, comes to me the thought that presents itself through a variety of phases—can a man be pre-eminent in any specialty without paying too dear a price for his eminence? Is the fact of this eminence a clog to his being fairly proficient, or, perhaps, companionable in general lines of thought? If this workman carries thoughts of his work home with him in the evening, and has them on Sundays, and is never happy unless he is working to a thousandth or the ten-thousandth of an inch, it seems to us that he is not getting quite all out of life that he ought to get. I should like to be acquainted with him, to know what books he reads, and how he thinks. I hope to know more of him some time.

Brass Founders' Power Sprue Cutter.

The machine herewith illustrated represents the most recent design of power sprue cutter built by The Stiles & Parker Press Company, of Middletown, Conn., of which they make four sizes.

It will be noticed that these machines are designed with special reference to making it possible and convenient for the operator to hold his castings in any way or position that he may find most desirable. The press is strong, roomy, and easily accessible in all its parts. Instead of having to forge a special stem on cutters, which is expensive and allows but a limited amount of wear, these cutters are made of bar-tool steel without any forging or machining, simply grinding them to a cutting bevel on an ordinary grindstone. They are both adjustable, so that they can be used up almost to the last inch, and can always be kept so as to cut off the



BRASS FOUNDERS' POWER SPRUE C

gate without touching each other, preserves the keenness of their edg . automatic clutch, operated by the ot treadle, always causes the slide to stop at the top of the stroke, leaving the largest possible space for getting the gate into position for the next cut. When the operator is ready, a light pressure on treadle will cause another stroke almost instantaneously.

Many of the largest brass goods manufacturers are now using these machines, which are working, we are told, to their entire satisfaction.

The Company also manufacture a machine of this character to be worked by foot power.

Sketches of an Apprenticeship.

BY W. S. ROGERS.

Talking about makeshifts to do odd sorts of jobs, and get work out, brings to mind a little incident I came in contact with recently.

Two young cubs in a stove foundry had built a bob-sled for coasting down the hills around Troy, New York. After it was all completed with steering gear, etc., they found the gong bell had been forgotten. Of course, it would have been easy to have bought one at some hardware store, but these two youngsters had built the bob, and they proposed to build the gong that went with it. To get a pattern for a ten-inch bell was easy, and just as easy was it to take home some sand and molders' supplies, rig up a flask and mold the bell. But it was not so easy to melt the brass and pour off. Those two cubs thought hard, and as ideas developed and took tangible form, here is about what happened.

The family wash boiler was mounted and lined with fire-brick and cement from a new dwelling being erected near by, and the cupola was ready. A cheese-box from the grocery store, fitted up with a wooden shaft through its center, and carrying wings inside the box, with a small wooden pulley outside, made the blower, while a piece of rain spout off the corner of the house connected the blower to the cupola. A lot of scrap, brass cuttings, old stop-cocks, and other brass accumulations that usually gather round a house where boys are, were in that cupola to be melted and poured into the mold. That fan must travel pretty fast to do that, and our cub engineers had to think hard.

Over in a neighbor's yard stood a four-foot grindstone. It was but short work to get it over and in line with the small pulley on the cheese box; a belt borrowed from the machine shop in the vicinity made the circuit complete, and the new foundry was ready for business.

The fire was lighted, the grindstone started, and in due time the metal poured off, and a nice good casting made, that many a jour. molder might be proud of.

Did they return the belt to the machine shop, take back the grindstone, and put the rain spout back on the corner of the house?

That I don't know. They made the gong for their "bob," accomplishing tangible and satisfactory results without any visible resources, and displaying inventive ability that some men sitting in back attic offices, hungry, while their M. E. shingle adorns the elevator entrance five stories below, would give worlds to possess.

One of these foundry cubs tells me that he has left the foundry "because the boss didn't keep his word with him." That was right. A proprietor or foreman that makes promises to an apprentice, and fails to keep them, ought to be in jail. It is better to be a good laborer than a half-made journeyman molder or machinist.

I knew a foreman once who promised his firm to put the entire plant on piece-work in three months. At the end of *six* months he did not know the cost of any one piece made in the shop. Was he incompetent? No, he did not intend keeping his word when he made the promise. Piece-work would have meant increased earnings for the employes and dividends for the firm, but with his narrow and contracted mind, he could see his own value diminish, so he broke his word before it was given.

A friend once asked me to design for him a certain machine wanted by the government. If he only had a drawing of such a machine he could get the order, sure. I had no time to work on it in daylight. I would have to do it at home nights. "All right," he said, "go ahead and keep your time on the job, and I'll pay you." Well, he got the drawing, and also got the order and ——— me? Oh! I almost forgot that; I got a stogie, three for a nickel. Was he perfectly honest in his dealing? Yes, I think so, but some men are everlastingly promising to do something for jours, apprentices, clerks, customers, etc., promiscuously, and not being able to recall all of them, the greater mass of promises go by default, and we learn by example to go wrong. Moral: Don't work for a man who cannot keep his word.

A sad evidence of the severity of the struggle for existence is to be found in the experience of some of the accident insurance companies. It was found that policies under which $2,500 were paid for the loss of either hand resulted in many applications for payment, and it was noticed that a large preponderance of the hands lost were left hands. The indemnity was reduced to a much smaller amount, and claims for lost hands almost entirely ceased, while those for the loss of a foot correspondingly increased, the indemnity for the loss of a foot having remained at the same figure. Other changes were made and results noted, which seemed to show conclusively that there are large numbers of men who were ready to thus mutilate themselves for a matter of about $2,000.

There is a bill before the New York State Assembly proposing to tax deposits in savings banks when they exceed $1,000. Referring to this bill, President Coleman, of the department of taxes, says:

"It is a most unwise and unjust bill, because the majority of such moneys belong to the thrifty laborer and mechanic, or are deposited by executors and trustees for safe keeping for the benefit of widows and orphans. It would have a tendency to reduce deposits, and would discourage savings, because the tax would almost, if not quite, equal the interest received. The well-to-do merchants and business men, or those living on their means, do not usually put their money in savings banks; and when they do, they are careful to arrange their indebtedness so that they can 'swear off' and escape their personal tax."

The *Pittsburgh Dispatch* credits a railroad ticket agent with saying:

"It is the old story. People feel they have done a smart and righteous act if they beat a railroad, but if they were posted they would know that it is the poor clerks and hard-working employes who suffer. The man who walks away with too much change, or takes two tickets which were given him by mistake when he was entitled to one, doesn't stop to think that it is not the company that bears the burden of his trickery, but the agent. He is responsible for all shortages caused by his blunders, and it comes out of his salary."

Our attention has been called to the fact that we have, in our issue of March 26, located the Concord Reformatory in the wrong Concord, as it is in the State of Massachusetts instead of in Concord, N. H. Its location, so far as the purpose of our editorial is concerned, makes no difference.

Mr. James Riordan, of 728 Hancock street, Topeka, Kansas, would like to hear some tidings of a friend of his, a machinist named Albert Potter, who at one time lived in Topeka, but when last heard from was somewhere in Texas.

Machinists' Supplies and Iron.

NEW YORK, March 28, 1891.

Iron—American Pig—The market has shown increased activity within the past few days, and prices are very irregular, though not in the main quotably altered.

We quote No. 1 Foundry, Standard Northern brands, $17 to $18; No. 2, $15.75 to $17; Gray Forge, $14.25 to $15; Southern brands No. 1 Foundry, $16 to $17.50; No. 2, $15.25 to $16; No. 3, $14 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $23, and Eglinton, $20.50.

Copper—The market is unsettled and irregular, and there is comparatively little business being done in Lake, which is still quoted at 14c. nominally, though it is understood that sales have been made at 13¾c. to 13⅞c. Casting copper is quoted 11¼c. wholesale, and in a small way 11¾c. to 12c.; Arizona Ingot, 12¾c. to 13c.

Lead—There is more activity in the market, and prices are somewhat firmer. Values range at 4.32½c. to 4.40c.

Spelter—Though the demand continues light, a firmer feeling seems to pervade the market, and values for Western range at 5.05c. to 5.10c.

Tin—There is little actual business being done, though speculative interest is lively. Values range at 19.90c. to 20.10c.

Antimony—The market is dull and easier.

We quote, Hallett's, 16c. to 16½c.; Cookson's, 18c. to 18½c.; L. X., 16½c.

Lard Oil—The upward tendency of lard affects prices, and some quotations are as high as 55 cents for prime.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Agents for fine surface gauges; big profits. Address E. G. Smith, Columbia, Pa.

Wanted—Position by first-class mech'l draftsman, capable of taking charge. Reliable, Am. Machinist.

Wanted—Position having charge of men, or as draftsman. References. Practical, Am. Mach.

Wanted—Pattern makers; 3 or 4 at once. Apply to The Pond Machine Tool Co., Plainfield, N. J.

Wanted—A few first-class machinists for engine work on tools and erecting floor. The Ball Engine Company, Erie, Pa.

Wanted—Two experienced men to run screw machines; steady employment and fair wages guaranteed. L. S. Starrett, Athol, Mass.

Competent machine shop foreman desires a position outside of New England; printing press work preferred. Address Box 76, Am. Machinist.

Wanted—By thorough practical boiler maker, position as foreman; sober and reliable; 12 years in similar position. Address V. G., 636 E. Sixth st., N. Y.

Wanted—To correspond with capable machinists accustomed to fitting up lathes. Address W. S., care of American Machinist.

Wanted—Tool maker thoroughly capable of taking charge of tool-room wishes engagement; south of Phila., preferred. Address Box 72, Am. Machinist.

Wanted—By practical pushing mechanic, position as supt., or foreman on engine, machine tools, and fine work, or outside work. Box 71, Am. Mach.

Wanted—Foreman for machine shop on engine work; good wages will be paid an experienced man. Address, giving references, J. H. McEwen & Co., Ridgway, Pa.

Wanted—First-class boiler maker to take half interest in shop in small town. Substantial and growing business guaranteed. Wm. Bartley & Sons, Bartley, N. J.

An educated designer, experienced in shop steel works, tool and engine design, and shop management, desires an engagement. A 1 references. Address New York, care of American Machinist.

Wanted—Foreman for brass finishing department on valves, cocks and specialties; must have executive ability, and be familiar with modern tools. Address, stating salary req'd, Box 75, Am. Machinist.

Boiler Makers Wanted—Good wages and steady work to steady, reliable men who apply at once. Merrill-Stevens Engineering Co., 138 and 140 E. Bay st., Jacksonville, Fla.

Wanted—Good machinists who understand building and erecting looms and other weaving machinery; steady employment. Address Schaum & Uhlinger, Philadelphia.

Wanted—Practical machinist (with some money) capable of tak'g charge of general mach. works, and men, to take interest in a well-established machine works in a live gas city. Address C., Am. Machinist.

Wanted—A man who thoroughly understands repair work on small intricate and fine machinery; must be sober and well recommended; steady employment can be given such a man. Address, stating wages wanted, The Ames-Bonner Co., Toledo, O.

Wanted—A young man with thorough experience with modern Corliss engines, capable of making a full line of drawings; an A1 opening with a company about to start in this line. Address with age, exp., and wages expected, Box 74, Am. Machinist.

Wanted—An active man as foreman or supt.; one up in modern machine shop practice, and handling men; must understand engine construction; one having experience in pumping machinery preferred; state age, experience, and salary expected. Address Box 73. Am. Machinist.

Wanted—Position as draftsman or assistant superintendent in machine works by a technical graduate (Swede) 32 years old, who has been assistant superintendent in large factory, and has 10 years' experience as draftsman and machinist; best of references. Address J. P., Am. Machinist.

Wanted—A first-class tool designer and maker to take charge of the designing and making of tools for small work; will have charge of thirty tool makers; steady employment and good salary to a strictly first-class man; no other but one of experience in small and close work need apply. Address National Cash Register Co., Dayton, Ohio.

Wanted—A first-class mechanic having $5,000 to engage with an established concern in the manufacture of machine tools in the best machine tool center in the West. Have orders for three months ahead, and can secure order at once for $30,000 in addition. Only first-class man with executive ability, having had experience in manufacturing high grade machine tools, need apply. Address Business, American Machinist.

Sales Agent Wanted—For water tube boilers and general machinery, with headquarters at our main office, a mechanical engineer preferred, with capacity for eventually looking after outside business, and ability to design and direct the construction of complete steam plants; all communications must be by mail, and will be held strictly confidential; interviews arranged later on. Address, stating salary expected, and give references, National Water Tube Boiler Co., New Brunswick, N. J.

To Superintendents and Others—Two gentlemen in the vicinity of New York City would like to engage in the manufacture of some article of ready sale, and in which there is a good profit. For this purpose they would like to meet with a practical man who has the knowledge and ability to establish and superintend such an enterprise. To a suitable person a certain interest would be given. State full particulars as to nature of business. References required. Address X. P. Q., Am. Mach.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 5 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

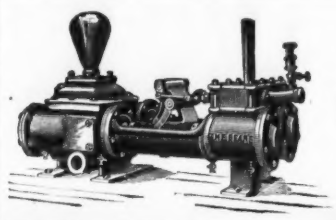
Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

For Sale—Yale & Towne hand traveling crane, 4,000 pounds, 18 feet span, in first-class order, with Harrington hoist, very little used, and a bargain. Samuel C. Tatum & Co., 264 Water street, Cincinnati, O.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.



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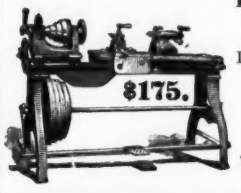

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CAN BE FORGED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
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CHARLESTON, W. VA.

"TIME IS MONEY."
"The smith his iron measures
Hammered to the anvil's chime."—Longfellow.
"And his **BRADLEY HAMMER** treasures,
Since it saves him work and time."—Some-other-fellow.
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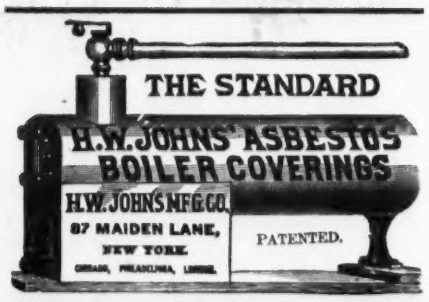

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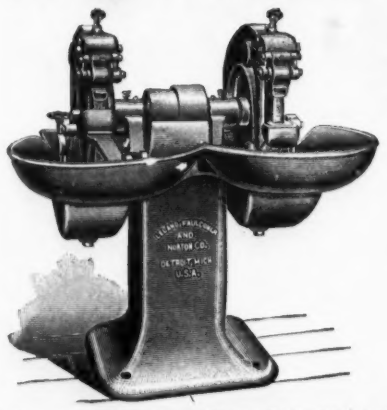

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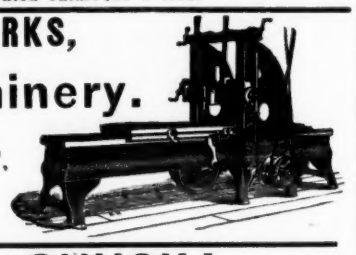

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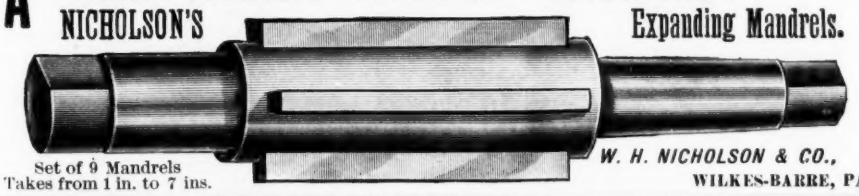

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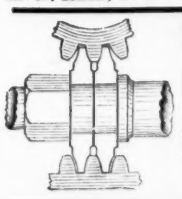

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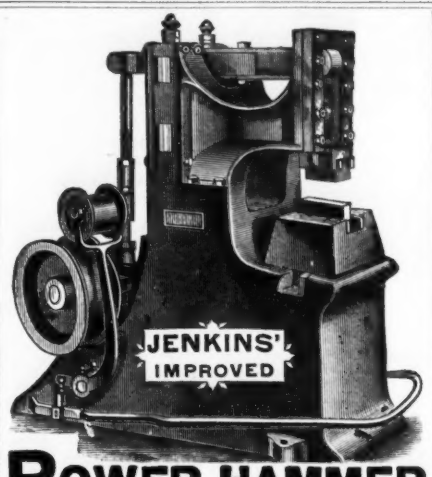

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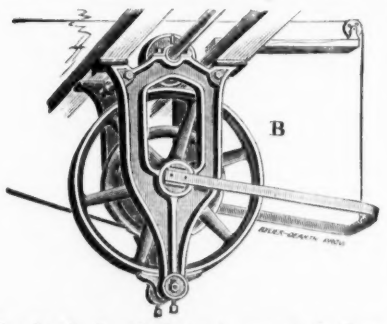

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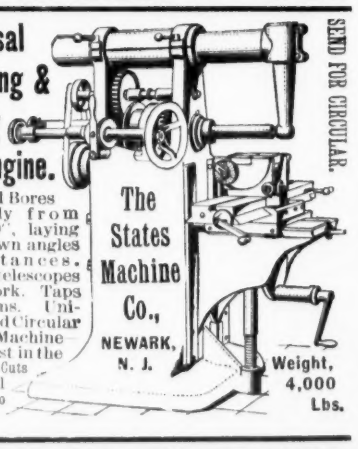

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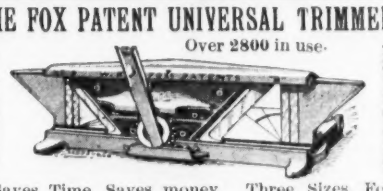

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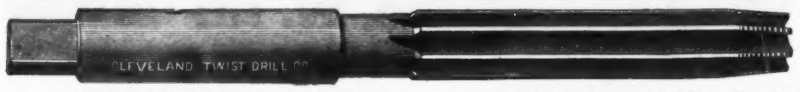

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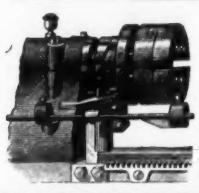

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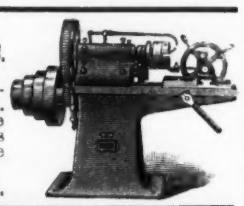

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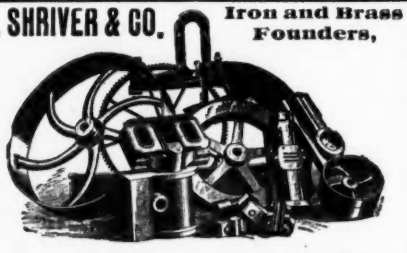

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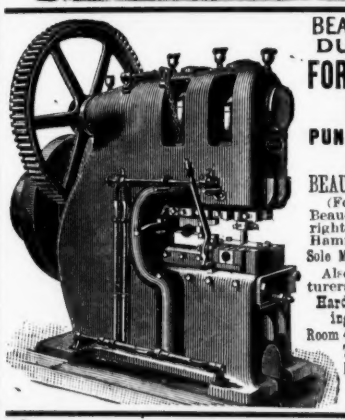

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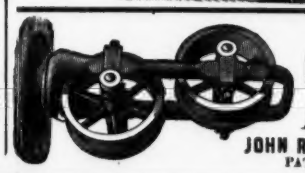

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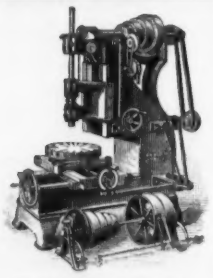

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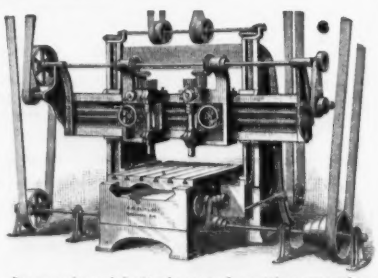

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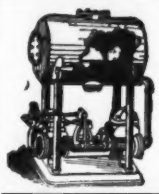

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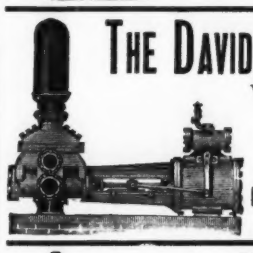

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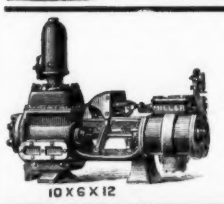

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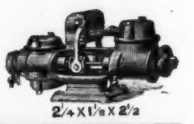

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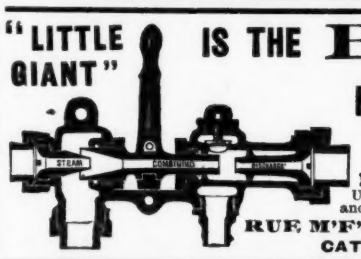

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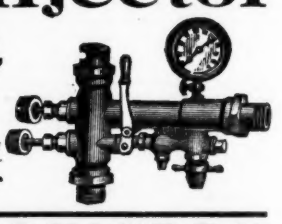

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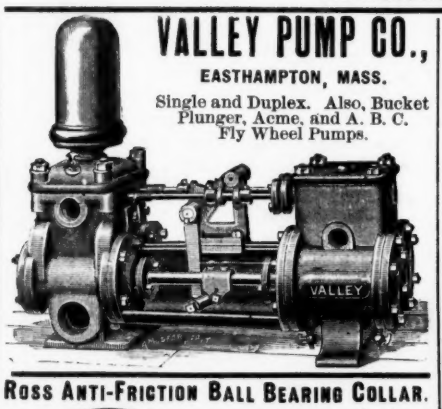

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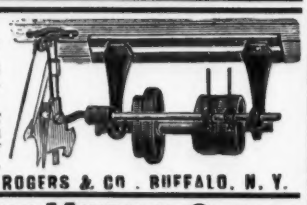

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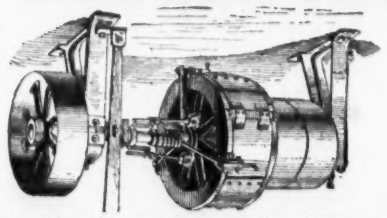

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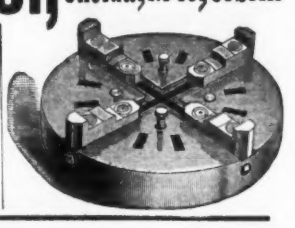

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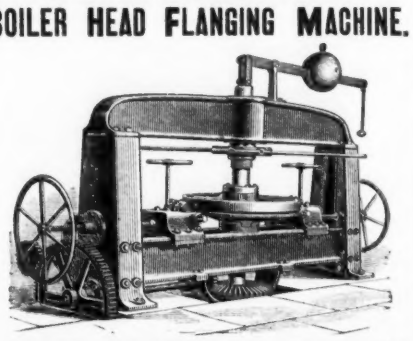

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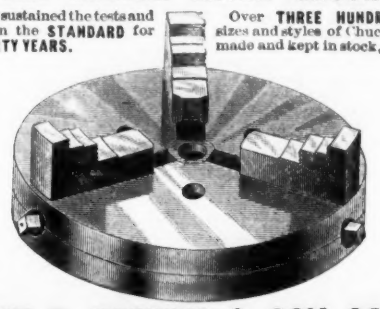

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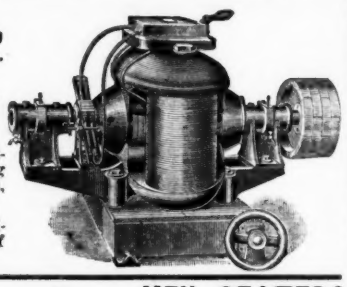

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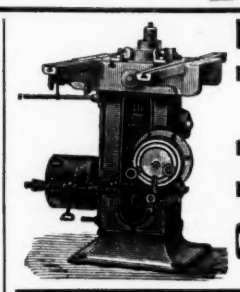

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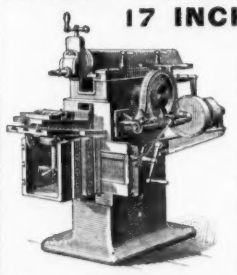

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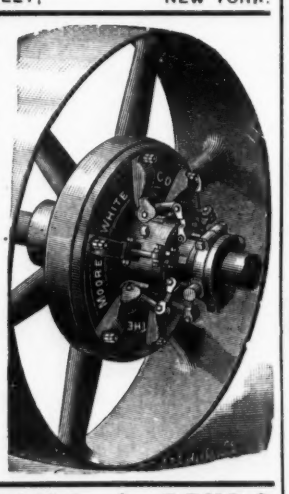

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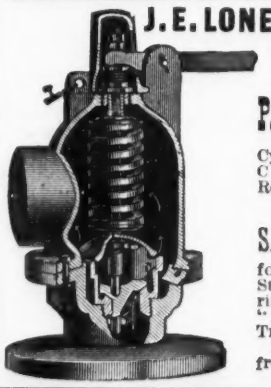

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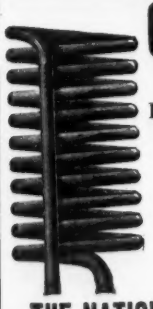

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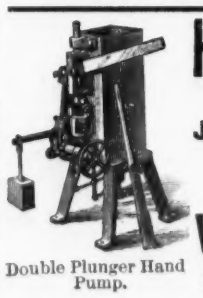

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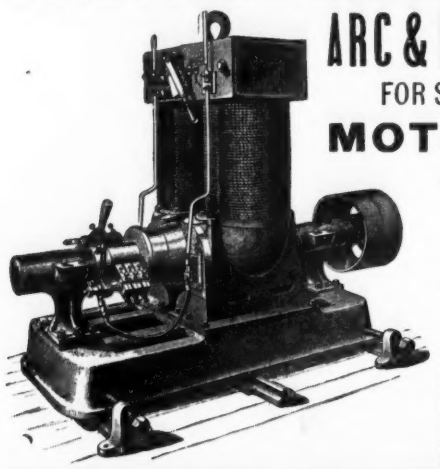

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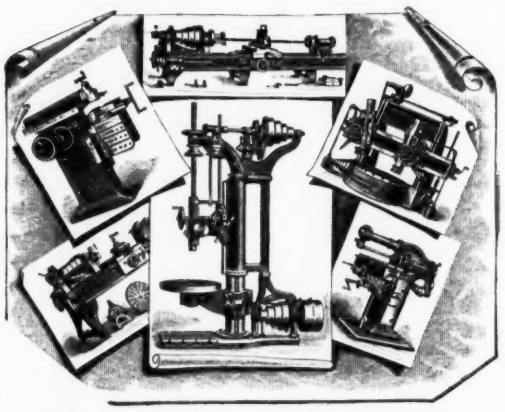

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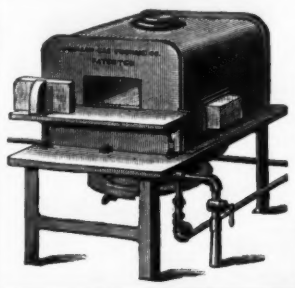

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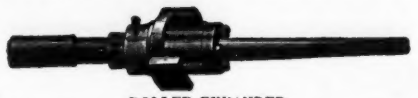

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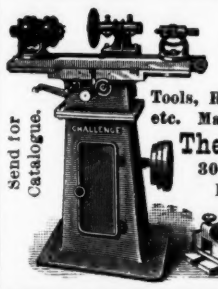

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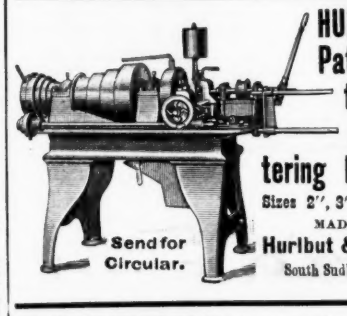

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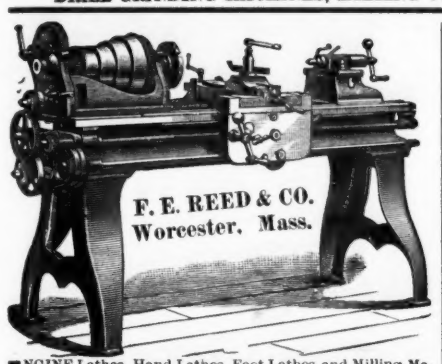

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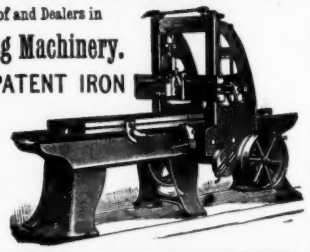

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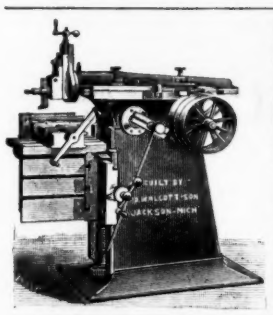

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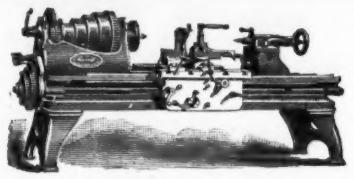

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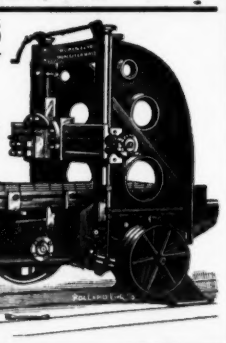

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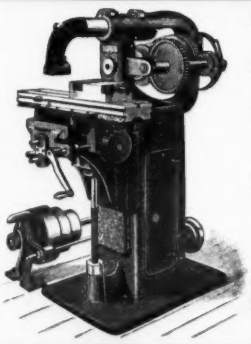

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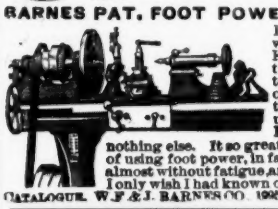

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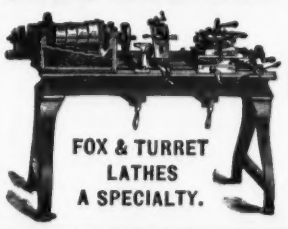

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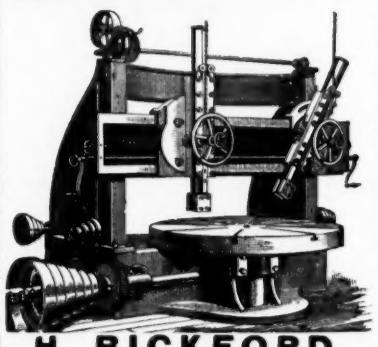

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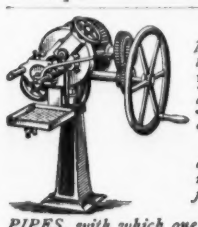

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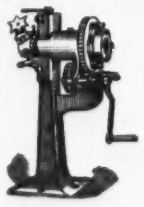

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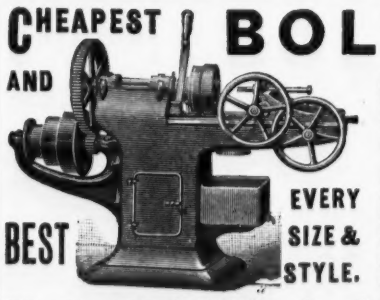

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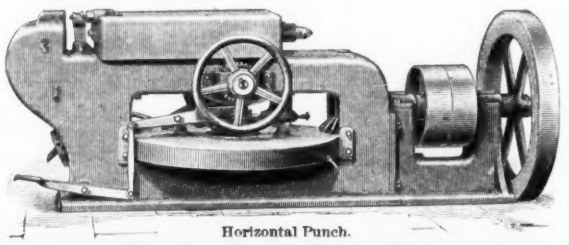
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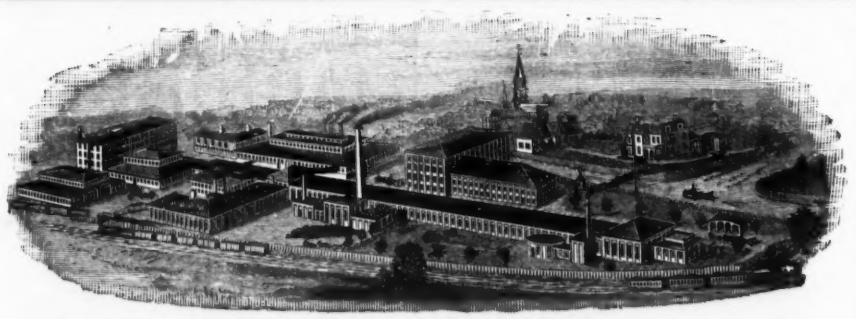
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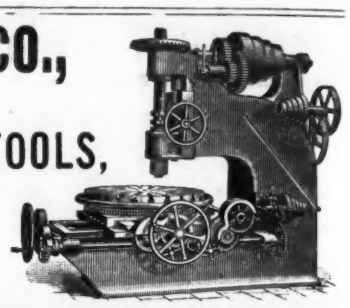

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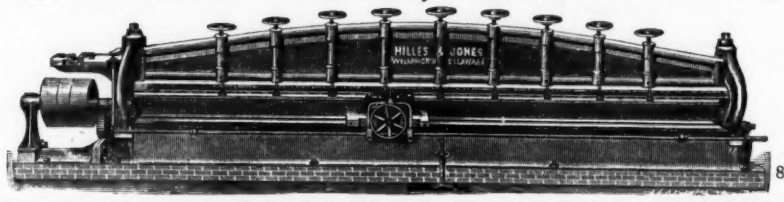

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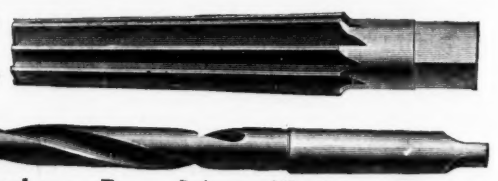

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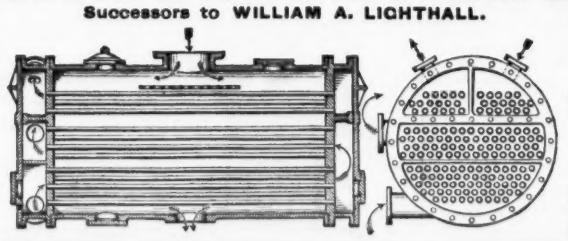

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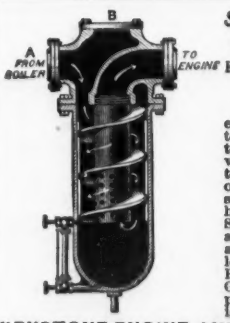

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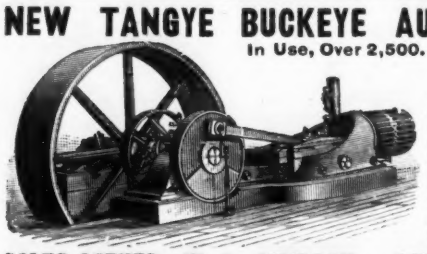

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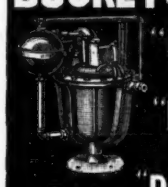

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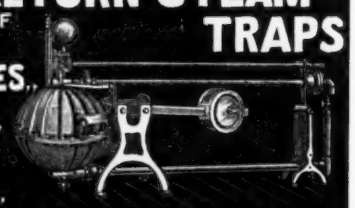

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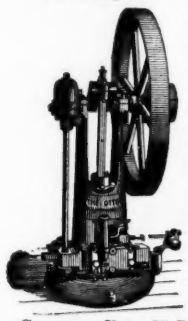

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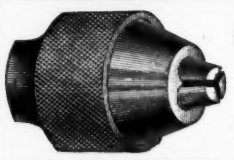

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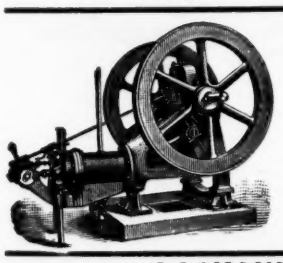

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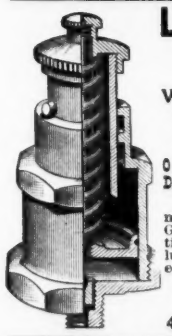

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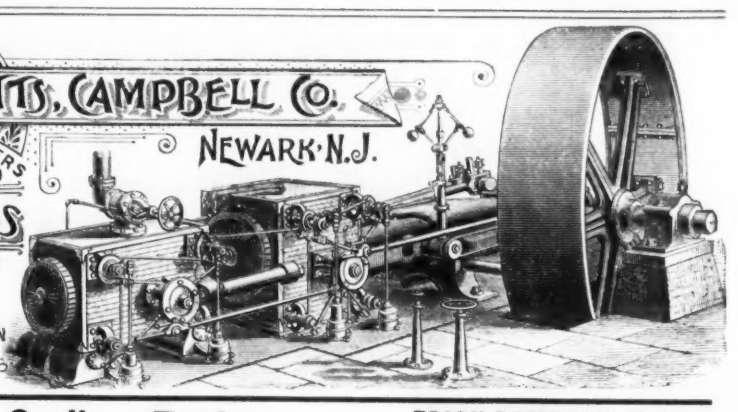

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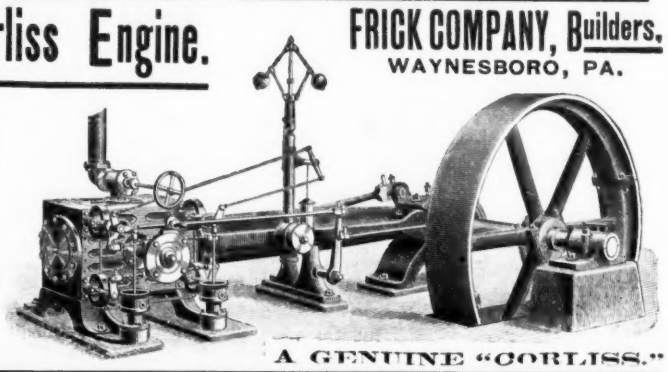

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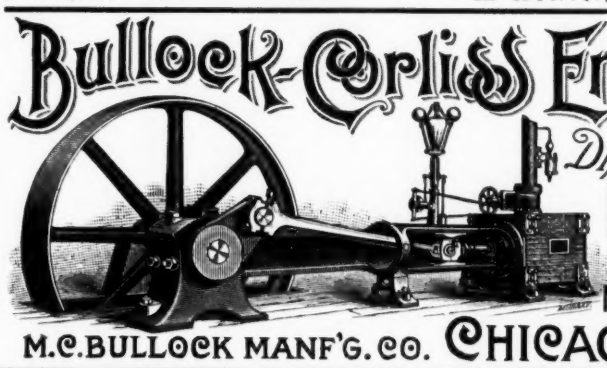

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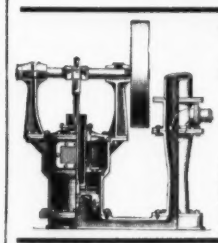

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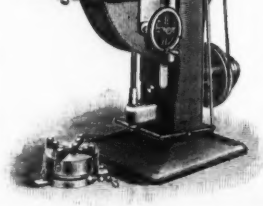

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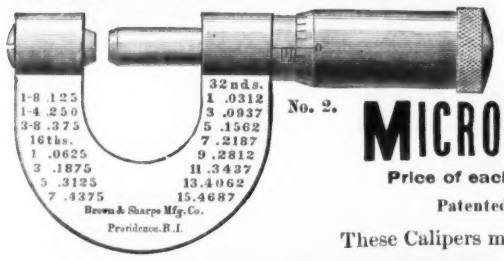

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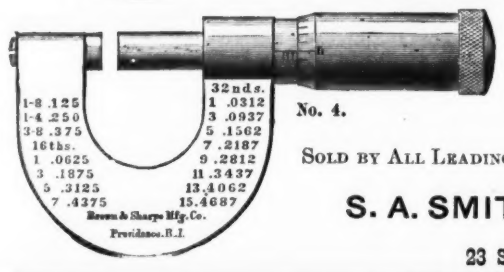

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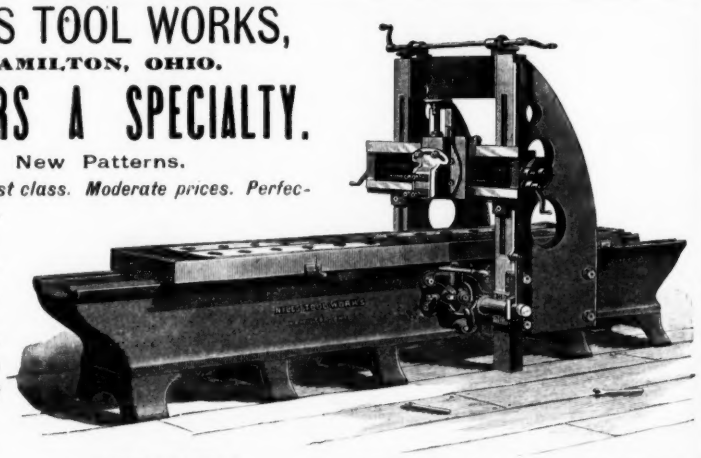

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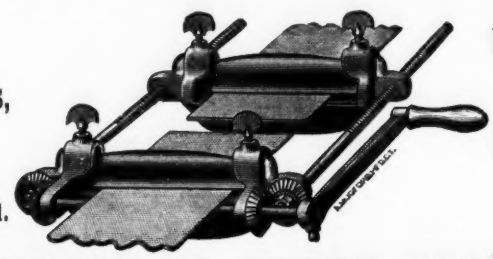

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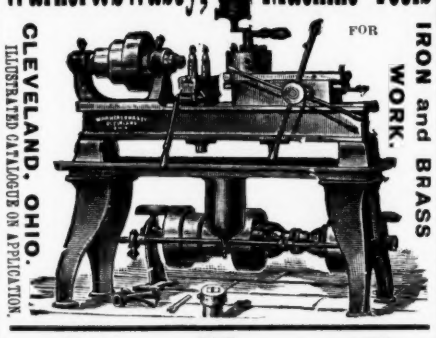

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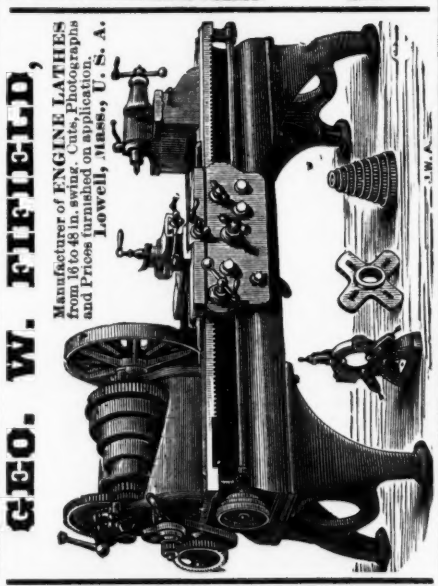

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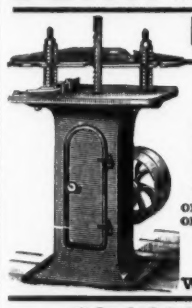

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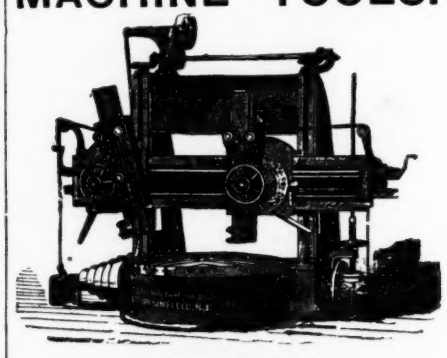

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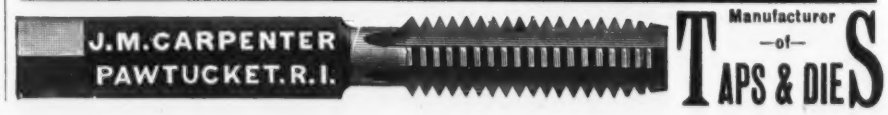

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